CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
PHYSICS
Paper I: Mathematical Physics, Properties of Materials and Relativity

Duration: 3 Hrs.   Max. Marks: 80

PART – A

1.   **Answer any TWELVE of the following:** $12 \times 1 = 12$

    i)   Define time derivative of a vector.
    ii)   What is a differential equation?
    iii) Define argument of a complex number.
    iv) Write the standard form of first order linear differential equation.
    v)   Find the value of $(3 + j2) + (-7 - j)$.
    vi) Why fluids possess only bulk modulus?
    vii) Define surface tension.
    viii) What is the effect of pressure on viscosity?
    ix) Give the advantage of I-section girders.
    x)   Define Poisson's ratio.
    xi) Define non-inertial frame of reference.
    xii) Write the expression for Coriolis force.
    xiii) Mention any nuclear phenomena supporting Einstein's mass-energy relationship.
    xiv) Define proper length.
    xv) What is a fictitious force?

PART – B
UNIT – I

Answer any TWO of the following: $8 \times 2 = 16$

2.   a) Prove that the area of a parallelogram with sides A and B is $|A \ X \ B|$.
    b) What is a second order differential equation? Give an example. Write the differential
        equation for the motion of pendulum and find its solution.   (2+6)

3.   a) Write the first order differential equation and find its solution by direct integration method.
    b) Deduce the expression for derivative of $\vec{A} + \vec{B}$, $\vec{A} - \vec{B}$, $\vec{A} \ X \ \vec{B}$, $\vec{A} . \vec{B}$.   (2+6)

4.   a) Explain exponential form of complex number.
    b) Write the second order differential equation and find its solution by numerical and auxiliary
        equation methods.   (2+6)

UNIT – II

Answer any TWO of the following: $8 \times 2 = 16$

5.   a) Give the applications of surface tension.
    b) What is a cantilever? Obtain an expression for the depression at the loaded end of a
        cantilever.   (2+6)

6.   a) What is Bending moment? Explain.
    b) Give the theory of comparing the coefficients of viscosity of two given liquids using
        Ostwald's viscometer.   (2+6)

7.   a) Give the applications of viscosity.
    b) Explain with theory, drop-weight method of determining the surface tension of a
        liquid.   (2+6)

UNIT – III

8. a) Prove that the rest mass of a photon is zero.
    b) Derive the equation of motion of a particle in a frame of reference moving with uniform acceleration relative to an inertial frame and hence obtain an expression for Pseudo force. Give one example for Pseudo force.   (2+6)

9. a) What is Coriolis force? Write an expression for it.
    b) What is the meaning of Mass-energy equivalence? Establish mathematically Einstein's mass-energy relationship.   (2+6)

10. a) Find the energy equivalent of 1Kg of matter in MeV.
    b) State the basic postulates of special theory of relativity and hence obtain Lorentz transformation formulae.   (2+6)

PART –C

11. Find the total work done in moving a particle in a force field given by $\vec{F} = 7xy\,\hat{\imath} + 2z\,\hat{\jmath} + x\,\hat{k}$ along the curve $x = 2t^2$; $y = t$ and $z = t^2 - 3t$ from $t = 0$ to $t = 1$.

12. If $\vec{z_1} = (4 - j\,3)$, $\vec{z_2} = (-8 + j\,2)$, add both analytically and using Argand diagram.

13. A uniform rod of length 1m is clamped horizontally at one end. A weight of 0.1 kg is attached at the free end. Calculate the depression of the free end of the rod. The diameter of the rod is 0.02 m; Young's modulus of the material of the rod is $1 \times 10^{10} \, N\,m^{-2}$.

14. A steel ball of radius 2×10^{-3} m falls in a vertical column of castor oil. The co-efficient of viscosity of castor oil is $0.7 \, N\,m^{-2}\,s$ and its density 0.98×10^3 kg m^{-3}. The density of steel is $7.8 \times 10^3 \, kg\,m^{-3}$ and $g = 9.8 \, m^{-2}$. Find its terminal velocity.

15. At what speed must a particle move for its mass to be four times its rest mass?

16. The length of a rocket ship is 100 m on the ground. When it is in flight its length observed on the ground is 99 m. Calculate the speed?

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PHY 101.2

Reg. No.....................…..….

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
PHYSICS
Paper I: Mathematical Physics, Properties of Materials and Relativity

Duration: 3 Hrs.   Max. Marks: 80

PART – A

1. a) **Answer any TEN of the following:**   10×1=10
    i)   Write the expression for torque in vector form.
    ii)   What is a complex number?
    iii)   Define degree of a differential equation.
    iv)   State Fourier's theorem.
    v)   Define Poisson's ratio.
    vi)   What is meant by neutral layer of a beam?
    vii)   When there are no external forces, what determines the shape of a liquid drop?
    viii)   What is the effect of temperature on viscosity?
    ix)   Define an inertial frame of reference.
    x)   What happens to the length of an object when it moves with the speed of light?
    xi)   Define proper time.
    xii)   Write the expression for variation of length with velocity.

    b) **Answer any FIVE of the following:**   5×2=10
    i)   Define dot product of two vectors and discuss the main characteristics of this product.
    ii)   Represent $(4 + j5)$ and $(8 - j9)$ on Argand diagram.
    iii)   Show that the elastic potential energy of a stretched string is $\frac{1}{2}kx^2$ where k is the force constant and 'x' is the extension.
    iv)   On what factors does the term angle of contact depend?
    v)   State and prove Galilean principle of relativity.
    vi)   Find the energy equivalent of 1kg of matter in MeV.

PART – B
UNIT – I

Answer any TWO of the following: 2×10=20

2. a) Obtain expressions for radial and transverse components of velocity and acceleration of a particle.
    b) Find the work done in moving a particle in a force field given by $\vec{F} = 7xy\hat{i} + 2z\hat{j} + x\hat{k}$ along the curve $x = 2t^2, y = t$ and $z = t^2 - 3t$ from $t = 0$ to $t = 1$.

3. a) What is a second order differential equation? Give an example. Write the differential equation for simple harmonic oscillation and find its solution.
    b) If $\vec{Z_1} = (6 - j2), \vec{Z_2} = (2 - J5)$, subtract both analytically and using Argand diagram.   [6 + 4]

4. a) Analyse the square wave using Fourier's theorem and draw relevant graph.
    b) The acceleration of a particle at any time is given by $\vec{a} = 12\cos2t\hat{i} - 8\sin2t\hat{j} + 16t\hat{k}$. If velocity $\vec{v}$ and displacement $\vec{r}$ are zero at $t = 0$, find $\vec{v}$ and $\vec{r}$ at any time.   [6 + 4]

UNIT – II

5. a) What is a cantilever? Obtain an expression for the depression at the loaded end of a cantilever.
   b) Find the amount of work done in twisting a steel wire of radius 1mm and length 0.25m through on angle 45°. Rigidity modulus of the steel $= 80 \times 10^9$ Nm^{-2} [6 + 4]

6. a) Derive the general expression for the excess of pressure due to surface tension inside a liquid surface.
   b) Calculate the work done in blowing a soap bubble of radius 5cm. Surface tension of soap solution is 3×10^{-2} Nm^{-1}. [6 + 4]

7. a) Using Stokes method, derive an expression for the terminal velocity of a liquid.
   b) A steel ball of radius 2mm falls in a vertical column of castor oil. The coefficient of viscosity is $0.8\ Nsm^{-2}$ and density is $970\ kgm^{-3}$. The density of steel ball is $0.8 \times 10^4 kgm^{-3}$ and $g = 9.8ms^{-2}$. Find the terminal velocity. [6 + 4]

UNIT – III

8. a) Write Lorentz - transformation equations and obtain an expression for time dilation.
   b) A rod of length 1.5m is moving with a velocity 0.75c. Calculate the percentage contraction in length. [6 + 4]

9. a) Obtain relativistic law of addition of velocity using Lorentz – transformation equation.
   b) Calculate the kinetic energy of an electron moving with a velocity of 0.98c. [6 + 4]

10. a) Deduce relativistic expression connecting energy and momentum. Hence write down the formula for energy and momentum of a photon.
    b) A spaceship is launched from the earth with velocity 0.9c. The spaceship then launches a rocket in the forward direction with a velocity 0.9c relative to spaceship. Calculate the velocity of the rocket with respect to the earth. [6 + 4]

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18PHY 301   Reg. No...........................

CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
PHYSICS
Paper III: Acoustics and Optics

Duration: 3 Hrs.   Max. Marks: 80

PART – A

1. a) **Answer any TWELVE of the following:**   12×1=12
    i)   Define relaxation time.
    ii)   Name the periodic motion which is not oscillatory.
    iii) Define Phase velocity of a particle.
    iv)   Why transverse waves cannot be set up in a fluid?
    v)   Mention any one method of producing ultrasonic waves.
    vi)   What is interference of light?
    vii) Define fringe width.
    viii) On what factors the colours observed on a soap bubble depend?
    ix)   Which method is employed to obtain coherent sources in Newton's rings?
    x)   What is an interferometer?
    xi)   Name the two types of diffraction.
    xii) What is a zone plate?
    xiii) Mention any one application of retarding plates.
    xiv) Give one example each for laevo rotatory and dextro-rotatory substance.
    xv)   Give the SI unit of specific rotation of a solid and solution.

PART – B
UNIT – I

Answer any TWO of the following: 2×8=16

2. a) Explain why the velocity of sound is greater in solids than in gases?
    b) What are forced oscillations? Derive an expression for the amplitude of forced
        vibration of a body.   [2 + 6]

3. a) Troops crossing over a suspension bridge are ordered to break up. Why?
    b) Assuming the expression for velocity of longitudinal waves in a fluid, deduce
        Newton's formula for the velocity of sound in air and apply Laplace's Correction.
                                                                   [2 +6]

4. a) Explain why we cannot hear an echo in a small room?
    b) Derive the expression for for velocity of sound in air using Helmholtz resonator. [2 +6]

UNIT – II

Answer any TWO of the following: 2×8=16

5. a) Explain the use of Compensating glass plate in Michelson's interferometer.
    b) What is a biprism? With a neat labeled diagram explain the formation of interference
        fringe with the help of a biprism.   [2 + 6]

6. a) Explain briefly the principle behind the phenomenon of interference at thin films.
    b) Discuss the formation of interference fringes when a thin wedge shaped film is seen by
        normally reflected light. Calculate the thickness of thin air film.
                                                                   [2 +-6]

7. a) Why the centre of Newton's rings dark and how can we get bright centre?
    b) Give the theory of interference and deduce the conditions for constructive and
        destructive interference.   [2 + 6]

UNIT – III

2×8=16

8. a) How is Fraunhoffer's diffraction realized in practice?
    b) Give Fresnel's theory of optical rotation. [2 + 6]

9. a) Why light waves can be polarized while sound waves cannot be polarized?
    b) Briefly explain how oblique incidence method is used to determine wavelength by plane transmission grating. [2 + 6]

10. a) Distinguish between uniaxial and biaxial crystals with one example each.
    b) Explain the meaning of half period zones in case of plane wave front and show that the radii of half period zones are proportional to the square roots of the natural numbers. [2 + 6]

PART – C

Answer any FOUR of the following: 4×5=20

11. Equation $y = e^{j2\pi\left(\frac{t}{0.02} - \frac{x}{25}\right)}$ represents a longitudinal progressive wave with length expressed in cm time in sec. Calculate the amplitude, frequency, wavelength and velocity of the wave.

12. Calculate the velocity of sound in water and steel.
    Given: Young's modulue of steel = 20×10^{10} N m^{-2}
    Density of steel = 7800 kg m^{-3}
    Bulk modules B of water = 0.20×10^{10} N m^{-2} and
    Density of water = 1000 kg m^{-3}

13. A soap film of refractive index $\frac{4}{3}$ and of thickness 1.5×10^{-6} m is illuminated by white light incident at an angle of 60°. The light reflected by it is examined by a spectroscope in which a dark band is found corresponding to a wavelength of 500 nm. Calculate the order of interference of the dark band.

14. In a biprism experiment with monochromatic light, fringes of width 0.20 mm are observed at 1m from the slit. On introducing a convex lens 0.3 m away from the slit, two images of the slit are seen 7 mm apart at 1m from the slit. Calculate the wavelength of light.

15. A 20 cm long tube containing sugar solution, when placed in a polarimeter gives an optical rotation of 11°. If the specific rotation of sugar under the given experimental condition be 66° per decimeter, find the strength of the solution.

16. A diffraction grating having 4000 lines per cm is illuminated normally by light of wavelength 500nm. Calculate the angular dispersion (dispersive power) in the third order spectrum.

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Reg. No.....................................

CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
PHYSICS
Paper III: Acoustics and Optics

Duration: 3 Hrs.   Max. Marks: 80

PART – A

1. a) **Answer any TEN of the following:**   10×1=10
    i)   What is a Helmholz resonator?
    ii)   What are forced vibrations?
    iii)   Define group velocity of wave.
    iv)   What are shock waves?
    v)   What is interference of light?
    vi)   Why do colours on a soap bubble change?
    vii)   What do you mean by wave front?
    viii)   Define biprism.
    ix)   What is diffraction of light?
    x)   What is grating element?
    xi)   What types of wave exhibit polarization?
    xii)   What is a polarizer?

    b) **Answer any FIVE of the following:**   5×2=10
    i)   Write the characteristics of Simple harmonic motion.
    ii)   Write a note on 'mach number' and its applications.
    iii)   Why should the two slits be narrow in Young's double slit experiment?
    iv)   What is the difference between circular fringes of Michelson interferometer and Newton's rings?
    v)   Distinguish between resolving power and dispersive power of an optical instrument.
    vi)   State assumptions of Biot's law of rotatory polarization.

PART – B
UNIT – I

Answer any TWO of the following: 2×10=20

2. a) What are damped oscillations? Write the equation for displacement of damped oscillations of a vibrating body and discuss the different cases and represent them graphically.
    b) The total energy of a particle executing SHM of period 2π seconds is 1.024×10^{-3}J. After a time of $\pi/4$ s, the displacement is $0.08\sqrt{2}$m. Calculate the restoring force at this instant and find the amplitude and mass of the particle.

3. a) Derive an expression for velocity of transverse vibrations of a stretched string.
    b) A wire of 0.5m long vibrates 100 times per second. If the length of the wire is shortened to 0.4m and the stretching force is increased four times the original value, what will be the frequency?   [6 + 4]

4. a) Derive the expression for velocity of sound in air using Helmholtz resonator.
    b) Calculate the percentage change in the velocity of sound through air due to change in temperature from 20°C to 35°C.   [6 + 4]

UNIT – II

5. a) Give the theory of interference and deduce the conditions for constructive and destructive interference.
    b) In a biprism experiment with sodium light, fringes of width 0.02cm are observed at 1m from the slit. On introducing a convex lens 0.3m away from the slit two images of the slit are seen 0.7cm apart at 1m from the slit. Calculate the wavelength of sodium light.

    [6 + 4]

6. a) Explain the interference due to a wedge shaped film and obtain expression for fringe width.
    b) Two glass plates enclose a wedge shaped air film touching at one edge and are separated by a thin wire of 0.06mm diameter at a distance of 0.18m from the edge. Calculate the fringe width if $\lambda = 6 \times 10^{-7}$m. [6 + 4]

7. a) What are Newton's rings? Explain with necessary theory, the formation of Newton's rings due to reflection of monochromatic light.
    b) In moving one mirror in a Michelson interferometer through a distance of 0.1474mm, 500 fringes cross the centre of the field of view. What is the wavelength of light? [6 + 4]

UNIT – III

8. a) What is a zone plate? Derive an expression for its focal length.
    b) The inner most zone of a zonal plate has a diameter of 0.425m. Find the focal length of the plate when it is used with parallel incident light of wavelength 4471 Å from a helium lamp. [6 + 4]

9. a) Discuss the theory of a plane diffraction grating for oblique incidence.
    b) A diffraction grating having 4000 lines/cm is illuminated normally by lights of wavelength 500nm. Calculate the angular dispersion in the third order spectrum.[6 + 4]

10. a) Explain the method of production and detection of plane and circularly polarized light.
    b) The rotation of plane of polarization in a certain substance is 10°/cm. Calculate the difference between refractive indices for the right and left circularly polarized lights in the substance. Given $\lambda = 5893$Å. [6 + 4]

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Reg. No.............................

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
PHYSICS
Paper V: Spectroscopy and Quantum Physics

Duration: 3 Hrs.   Max. Marks: 80

PART – A

1. a) **Answer any TEN of the following:** $10 \times 1 = 10$
    i)   Give one limitation of Bohr atom model.
    ii)   What is Gyro-magnetic ratio?
    iii) What are the different kinds of molecular spectra?
    iv)   Mention any application of Raman effect.
    v)   What is a black body?
    vi)   Write Einstein's photoelectric equation and explain the symbols.
    vii) What is the relation between the phase velocity of particle and the group velocity of matter waves associated with the particle?
    viii) When does the Compton wavelength becomes equal to Compton shift?
    ix)   What is the main difference between the energy levels of a rigid rotator and harmonic oscillator?
    x)   Explain why the concept of orbits is irrelevant in wave mechanics.
    xi)   What are wave packets?
    xii) What is a free particle?

    b) **Answer any FIVE of the following:** $5 \times 2 = 10$
    i)   What is meant by space quantization of electrons orbits?
    ii)   How do you explain blue of the sky from Rayleigh scattering?
    iii) What is green house effect?
    iv)   Distinguish between electron microscope and optical microscope.
    v)   Give the physical significance of wave function.
    vi)   What are the probability density and zero point energy for a free particle in a linear potential box.

PART – B
UNIT – I

Answer any TWO of the following: $2 \times 10 = 20$

2. a) Describe the Stern-Gerlach experiment and discuss the results.
    b) A substance shows Raman line at 554.3 nm when excited with a radiation of wavelength 546.1 nm. Calculate a) The Raman frequency   b) The wavelength of the corresponding anti-stokes line.   (Given: h = 6.625 X10⁻³⁴ J s)   [6 + 4]

3. a) What is meant by fine structures of spectral lines? Explain the fine structure of sodium D-line.

    b) The most prominent Calcium line has wavelength 4226 $\overset{\circ}{A}$. Calcium atoms exhibit normal Zeeman effect in a magnetic field of 4T. Calculate the wavelength of component lines and separation between them. (Given : $\frac{e}{m}$ =1.758 X10¹¹ C kg⁻¹) [6 + 4]

4. a) Obtain an expression for rotational energy of a diatomic molecule and hence get the frequency and wave number of rotational spectra, assuming it to be a rigid rotator.
    b) The value of Bohr magneton is 9.2×10^{-24} J T^{-1} and Plank's constant is 6.625×10^{-34} J s. Calculate the value of $\frac{e}{m}$ of an electron. [6 + 4]

UNIT – II

Answer any TWO of the following: 2×10=20

5. a) Describe with necessary theory Davisson and Germer experiment for establishing wave nature of the electron and discuss it.
    b) Calculate the De-broglie wavelength associated with proton moving with a velocity equal to one twentieth of the velocity of light. (Given: $m_p = 1.67 \times 10^{-27}$ kg)
        h= 6.625×10^{-34} J s) [6 + 4]

6. a) Derive an expression of Compton shift and wavelength of scattered photon.
    b) Calculate the wavelength of radiation coming out of the furnace at 1500 K that has maximum intensity. Also specify the type of radiation.
        [Given: Wien's constant = 2.898×10^{-3} m K.] [6 + 4]

7. a) Discuss Planck's quantum hypothesis and deduce Planck's law of energy distribution for black body radiation.
    b) One milli-watt of light of wavelength 546 nm is incident on Çesium surface. Calculate the number of photoelectrons emitted per second and also the photoelectric current assuming the quantum efficiency to be 0.5% [Given: h = 6.625×10^{-34} J s]

UNIT – III

Answer any TWO of the following: 2×10=20

8. a) Starting from the wave equation, obtain an expression for one dimensional Schrodinger wave equation in time-dependent form.

    b) Calculate the energy difference between the ground state and the first excited state of an electron in a one dimensional potential box of width 1 $\overset{\circ}{A}$. [6 + 4]

9. a) Set up the Schrodinger wave equation for a free particle in a linear potential box and obtain eigen functions and eigen values.

    b) The energy of a linear harmonic oscillator in the second excited state is 0.07 eV. Calculate the frequency of vibration. [Given: h = 6.625×10^{-34} J s] [6 + 4]

10. a) Write down the Schrodinger wave equation and obtain expression for energy of a linear harmonic oscillator and discuss the energy level and probability curves.
    b) A particle is moving in a one-dimensional box of infinite height. What is the probability of finding the particle in a small interval Δx at the centre of the box, when it is in the energy state next to the lowest energy state? [6 + 4]

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PHY 502.2   Reg. No...............................

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
PHYSICS
Paper VI: Solid State Physics

Duration: 3 Hrs.   Max. Marks: 80

PART – A

1. a) **Answer any TEN of the following:**   10x1=10
    i)   What are Bosons?
    ii)   What is the atomic heat of an element according to Dulong and Pettit's Law?
    iii) Write Planck's formula for the energy of an atomic oscillator.
    iv)   Define drift velocity of electrons.
    v)   Draw the energy band diagram for an insulator.
    vi)   Which carrier is responsible for the current in a p-type semiconductor?
    vii) Give the symbol of Zener diode
    viii) What is photovoltatic effect?
    ix)   How many crystasl system are possible in a crystal structure?
    x)   Mention any two uses of X-rays.
    xi)   What is meant by a line defects?
    xii) Name the two classification of edge dislocation.

    b) **Answer any FIVE of the following:**   5x2=10
    i)   What are the assumptions of classical free electron theory?
    ii)   Show the difference between Einstein's and Debye's theories of specific heats of
          solids graphically.
    iii) What is doping? Name any one dopant each used in n and p-type semiconductor.
    iv)   What is the difference between avalanche and Zener breakdown?
    v)   Explain the origin of continuous X-rays.
    vi)   Name the classifications of crystal imperfections.

PART – B
UNIT – I

Answer any TWO of the following: 2x10=20

2. a) Show that both FD and BE statistics reduce to MB statistics at low densities and high
        temperatures.
    b) A copper slab of size 10 mm long, 2 mm wide and 0.1 mm thick has a current of 10A
        along its length. It is in a magnetic field of 1 T with the field perpendicular to
        2 mm X 10 mm face. Calculate the current density and Hall voltage if Hall coefficient
        is 0.55 m^3C^{-1}.   [6 + 4]

3. a) Derive expression for specific heat of solids using Debye's theory, assuming the
        expression for the number of possible modes of vibrations.
    b) In Aluminum (Atomic Weight=27), the transverse and longitudinal wave velocities are
        3110 m s^{-1} and 6370 m s^{-1} repectively. Calculate Debye frequency. Given Avogadro's
        number = 6.024x10^{26} / kmole. Density of Aluminum = 2800 kg m^{-3} [6 + 4]

4. a) Assuming the expression for density of energy states, find the average kinetic energy of electron at absolute zero.
    b) There are 2.5×10^{28} electrons per cubic meter of sodium. Calculate the Fermi energy and Fermi velocity. $[6 + 4]$

UNIT – II

Answer any TWO of the following: 2x10=20

5. a) Explain the formation of n-type semiconductor and give its energy band diagram.
    b) Calculate the conductivity of pure silicon at room temperature. Given carrier concentration $=1.6 \times 10^{10}$ per cm^3, $\mu_e = 1500 \ cm^2 \ V^{-1} \ s^{-1}$ and $\mu_h = 500 \ cm^2 \ V^{-1} \ s^{-1}$ $[6 + 4]$

6. a) Using V-I characteristics of a p-n diode, explain static and dynamic resistance under forward and reverse bias condition of a p-n diode.
    b) The resistance of intrinsic semiconductor is equal to $180 \ \Omega$ at $60^\circ C$ and $80 \ \Omega$ at $80^\circ C$. Calculate energy gap of semiconductor. Given $k = 1.38 \times 10^{-23} \ J \ K^{-1}$ $[6 + 4]$

7. a) With a neat diagram, explain the principle and working of a solar cell.
    b) The resistivity of Ge at $27^\circ C$ is $0.47 \ \Omega m$. Calculate the intrinsic carrier density. Electron mobility $= 0.38 \ m^2 \ V^{-1} \ s^{-1}$, Hole mobility $= 0.18 \ m^2 \ V^{-1} \ s^{-1}$. $[6 + 4]$

UNIT – III

Answer any TWO of the following: 2x10=20

8. a) What are Miller indices? Illustrate with an example.
    b) Calculate the smallest glancing angle at which the monochromatic X-ray of wavelength 0.1549 nm will be reflected from a quartz crystal which has an atomic spacing d = 4.255 Å. What is the highest reflecting order that could be observed with this radiation? $[6 + 4]$

9. a) With a suitable diagram, explain screw dislocation.
    b) The potential difference across X-ray tube is 5×10^5 V. What is the minimum frequency of X-rays emitted? What is the corresponding wavelength? $[6 + 4]$

10. a) Describe the Langevin's theory of paramagnetism and obtain an expression for paramagnetic susceptibility.
    b) Consider Helium atom in its ground state. Mean radius is approximated by the Bohr's radius in the Langevin formula using $N = 27 \times 10^{23} \ cm^{-3}$ for the atomic density of Helium gas. Calculate the diamagnetic susceptibility of helium atom. $[6 + 4]$

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CHOICE BASED CREDIT SYSTEM
FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
FUNCTIONS AND APPLICATIONS

Time: 2 Hrs   Max. Marks: 40

PART – A

I   Answer any FIVE questions. Each question carries 2 Marks   5x2=10

a)   The demand and supply of a commodity are given by $x_d = 81000 - 160p$ and
     $x_s = -4500 + 125p$. Find the equilibrium price and quantity.

b)   The total cost TC of producing x units of a commodity is given by TC=2000+4x. If each
     unit is sold at ₹ 24 per unit, find the level of output to make sure that the production breaks
     even.

c)   The purchase price of a car is ₹ 1,80,000. The car is used for five years and then resold for
     1,05,000. Assuming that the depreciation of the car is linear, write down a relation which
     expresses the book value (y) of car with its age (t)

d)   Solve the inequality $8x + 15 < 3x + 5$

e)   Find elasticity of demand of the function, $x = 100 - 5p$ at $p = 10$

f)   If $x = 2Y^2$, find income elasticity of demand.

g)   Define cross elasticity of demand.

h)   Find the nature of point of inflection of the function $y = x^3 - 15x^2 + 20x + 10$

PART – B

II   Answer any THREE questions. Each question carries 5 Marks.   3x5=15

a)   When price of a commodity is ₹ 30 per unit, its demand and supply are 600 and 900 units
     respectively. A price of ₹ 20 per unit changes the demand and supply to 1000 and 700
     units respectively. Assuming that the demand and supply equations are linear, find

                    i) the demand equation

                    ii) the supply equation

                    iii) the equilibrium price and quantity

b)   A company decides to set up a small production plant for manufacturing electronic clocks.
     The cost of initial set up is ₹ 8 lakhs. The additional cost for producing each clock is
     ₹ 300. Each clock is sold at ₹ 800. During the first month 1500 clocks are produced and
     sold.

     i) Determine the total cost function C(x) for the production of x clocks.

     ii) Determine the revenue function R (x)

     iii) Determine the profit function P (x)

     iv) How much profit or loss the company incurs during the first month

        when all the 1500 clocks are sold?

     v) Determine the breakeven point.

c)   The demand for skilled workers in an industry is $L_d = 1300 - 40\omega$ and its supply is $L_s = 100 + 80\omega$, Where L is the number of workers and ω is the wage rate per hour.

i) Find the equilibrium values of L and ω

ii) If the government wishes to rise the equilibrium wages to rupees 12 by offering a wage subsidy, find the value of L, the rate of subsidy and the cost of the subsidy to the government.

iii) If instead of subsidy the government declares a minimum wage of rupees 12 find the number of unemployed workers.

d)   The demand equation of the commodity is given by $p = 40 - 2x$ and the total cost of producing x units in $c = x^2 + 20x + 25$, where p is price and x denotes thousand units. Find the level of output to make sure that the business breaks even.

e)   Solve the double inequality $3x + 1 < 4x + 5 < 11 - 2x$

III   Answer any THREE questions. Each question carries 5 Marks.   **3x5=15**

a)   The price elasticity of demand of a commodity when price=₹10   and the quantity demanded = 25 units, is given to be 1.5. Find the demand equation of the commodity on the assumption that it is linear.

b)   The production function of a firm that uses only one variable input (labour) is $x = 125L + L^2 - 0.1L^3$. Find marginal cost if firm employs 20 units of labour and the wage rate is fixed at ₹ 90 per unit.

c)   The total revenue from the sale of good X is given by the equation $R = 60x - x^2$ for $0 \leq x \leq 60$ where R is total revenue and x is quantity. Find marginal revenue when price elasticity of demand is 2.

d)   A wholesaler of pencils charges rupees 24 per dozen on orders of 50 dozens or less. For orders in excess of 50 dozens, the price is reduced by 50 paise per dozen in excess of 50 dozens. Find the size of the order that maximizes his total revenue.

e)   A tour operator charges ₹136 per passenger up to 100 passengers with a discount of rupees 4 for each 10 passengers in excess of 100. Determine the number of passengers that will maximize the amount of money the tour operator receives.

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CHOICE BASED CREDIT SYSTEM
FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
MATHEMATICS
PAPER I: Calculus and Analytical Geometry

Duration: 3 hours   **Max Marks: 80**

PART A

Answer any TEN questions. Each question carries 2 marks.   **10x2=20**

1) Find the oblique asymptote of the graph of the function $f(x) = \dfrac{x^2 + 3}{x + 2}$

2) Give an example for a function where $f''(x)$ does not exist at a point of inflection.

3) Define concavity of the graph of a function.

4) Find the average value of the function $g(x) = -3x^2 - 1$ in $[0,1]$

5) Evaluate $\dfrac{d}{dx}\left(\displaystyle\int_x^5 3t \sin t \, dt\right)$

6) Evaluate $\displaystyle\int \sin^3 x \cos^2 x \, dx$

7) Evaluate $\displaystyle\int_0^{3/2} \dfrac{dx}{\sqrt{9 - x^2}}$

8) Find the domain and range of the function $w = \sqrt{y - x^2}$

9) Calculate $\displaystyle\lim_{(x,y) \to (0,0)} \dfrac{x^2 - xy}{\sqrt{x} - \sqrt{y}}$

10) Find the level curve of the function $f(x, y) = 100 - x^2 - y^2$ when $f(x, y) = 75$

11) If $f(x, y, z) = x \sin(y + 3z)$, find $\dfrac{\partial f}{\partial z}$ and $\dfrac{\partial f}{\partial x}$

12) Find the foci and directrices of the conic $6x^2 + 9y^2 = 54$

13) Find the eccentricity of the hyperbola $12x^2 - 27y^2 = 108$

14) Find the equation of the ellipse whose foci are $(\pm 4, 0)$ and directrices are $x = \pm 16$

PART – B

Answer any SIX questions. Each question carries 5 marks.   **6x5=30**

15) State and prove second derivative test for local extrema.

16) For the function $y = x^4 - 2x^2$, find local extreme points and point of inflection, and sketch the graph of the function.

17) For the curve $y = \dfrac{x^2 - 3}{x - 2}$ find the domain, critical points, intervals of increase and decrease, concavity, local extrema, points of inflection, asymptotes, and sketch the graph of the function.

18) State and prove Mean value theorem.

19) Verify the conditions of Rolle's Theorem for the function $f(x) = \dfrac{x^3}{3} - 3x$ in $[0,3]$ and find a number c satisfying Rolle's theorem.

20) Obtain a formula for the upper sum using Riemann sum by dividing the interval $[0,1]$ into n subintervals and find the area below the curve $f(x) = x + x^2$ in $[0,1]$ by taking limit as $n \to \infty$

21) If $f(x)$ is continuous in $[a,b]$ then prove that $F(x) = \int_a^x f(t)dt$ is continuous in $[a,b]$ and differentiable in (a,b) and $F'(x) = f(x)$

22) Obtain a reduction formula for $\int \sin^n x\, dx$

23) Evaluate i) $\int_0^{\pi/4} 4\tan^3 x\, dx$ ii) $\int_{-\pi/2}^{\pi/2} \cos^3 x\, dx$

PART – C

Answer any SIX questions. Each question carries 5 marks.   6x5=30

24) Find $\underset{(x,y) \to (0,0)}{\lim} \dfrac{4xy^2}{x^2 + y^2}$ if it exists, using definition.

25) Using definition prove $\underset{(x,y) \to (3,2)}{\lim} 3x - 4y = 1$ by finding a $\delta > 0$ for any $\varepsilon > 0$

26) Find the derivative of $w = xy + z$ along the path $x = \cos t,\ y = \sin t,\ z = t$ with respect to t. Also find the derivative at $t = 0$

27) If $u = x^2 + xy,\ x = r^2 + s^2,\ y = 3r - 2s,$ find $\dfrac{\partial u}{\partial r}\ \&\ \dfrac{\partial u}{\partial s}$ using chain rule

28) If $u = ye^x + xe^y,\ x = \cos t, y = \sin t,$ find the total derivative $\dfrac{du}{dt}$ using two methods

   i) Using Chain rule

   ii) Using substitution for x and y before differentiation.

29) Find the asymptotes and sketch the hyperbola $x^2 - y^2 = 1,$ find its foci and vertices.

30) The parabola $y^2 = 8x$ is shifted down 2 units and right 1 unit, to generate a new parabola. Find the equation of new parabola, vertex, directrix and focus.

31) Eccentricity of a hyperbola is $\dfrac{3}{2}$, one of its foci is $(1, -3)$ and corresponding directrix is y=2. Find the equation of the hyperbola.

32) If the coordinate axes are rotated through an angle α to remove the xy term in the hyperbola $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ then find an expression for α

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18MAT101   Reg. No. ....

Duration: 3 hours   Max Marks: 120

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
       2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A   10x3=30

1. a) Find the value of z in the open interval $(a,b) = (0,1)$ satisfying Cauchy's mean value
        theorem for the pair of functions, $f(x) = 3x^2 + 3x - 1$ and $g(x) = x^3 - 4x + 2$

    b) Evaluate $\lim_{x \to 1} \dfrac{1 - x + \ln x}{x^3 - 3x + 2}$

    c) Find the 5th degree Maclaurin's polynomial for the function $f(x) = e^x$

    d) Find critical numbers of the function $g(x) = \sin x \cos x$

    e) Find horizontal asymptotes of the function $f(x) = \dfrac{x}{\sqrt{x^2 + 1}}$

    f) Find the points of inflection for the function $f(x) = x^3 - 6x^2 + 9x + 1$.

    g) Find the radius of curvature at any point on the cycloid $x = a(1 + \sin t)$, $y = a(1 - \cos t)$

    h) Find a polar equation of a graph whose Cartesian equation is $x^2 + y^2 - 4x = 0$.

    i) Sketch the graph of the equation $r \cos \theta = -3$

    j) Find $\int \sin^4 x \, dx$

    k) Find $\int_0^{\pi/2} \sin^6 x \cos^8 x \, dx$

    l) Evaluate $\int_0^{\pi/2} \cos^7 x \, dx$

    m) Find the length of the line segment of the line $y = 3x$ from $(1,3)$ to $(2,6)$

    n) Find the area of the region enclosed by the graph of the equation $r = 2 + 2\cos\theta$.

    o) The region bounded by the curve $y = x^2$, x axis and the lines $x = 1$ and $x = 2$ is revolved about
        x axis. Find the volume of the solid generated. Take the elements of area parallel to axis of
        revolution.

PART - B

UNIT-I

2. a) If f and g are functions that are differentiable on an open interval I, expect possibly at the number a in I, suppose that for all $x \neq a$ in I. $g'(x) \neq 0$, then if $\lim_{x \to a} f(x) = 0$, $\lim_{x \to a} g(x) = 0$ and if $\lim_{x \to a} \dfrac{f'(x)}{g'(x)} = L$, then prove that $\lim_{x \to a} \dfrac{f(x)}{g(x)} = L$ (6)

   b) Find $\lim_{x \to 1} \left(\dfrac{1}{\ln x} - \dfrac{1}{x-1} \right)$ if it exists. (6)

   c) Find the third degree Taylor polynomial of $f(x) = x^{2/3}$ at $a = 4$ (6)

3. a) State and prove Cauchy's mean value theorem. (6)

   b) Find $\lim_{x \to \frac{\pi}{2}^-} \dfrac{\sec^2 x}{\sec^2 3x}$ if it exists. (6)

   c) Find the third degree Taylor polynomial of $f(x) = \cos x$ at $x = \dfrac{\pi}{4}$ (6)

UNIT-II

4. a) Find the dimensions of the largest rectangular field that can be enclosed with 240 m of fence. (6)

   b) If the function f is differentiable on some open interval containing c, and if $(c, f(c))$ is a point of inflection of the graph of f and if $f''(c)$ exists, then prove that $f''(c) = 0$ (6)

   c) Given $f(x) = x^4 + \dfrac{4}{3}x^3 - 4x^2$, find relative maxima and minima of f by applying second derivative test. (6)

5. a) Let c be a critical number of a function f at which $f'(c) = 0$ and let f' exist for all values of x in some open interval containing c. If $f''(c)$ exists and

   i) If $f''(c) < 0$ then prove that f has a relative maximum value at C.

   ii) If $f''(c) > 0$, then prove that f has a relative minimum value at C. (6)

   b) If $f(x) = x^{2/3}$, find the point of inflection of the graph of f and determine where the graph is concave upward and where it is concave downward. (6)

   c) Sketch the graph of function $f(x) = \dfrac{x^2}{x^2 - 4}$ (6)

UNIT-III

6. a) Find the radius of curvature at any point on the curve $y = c \cosh(x \mid c)$ (6)

   b) Show that the evolute of the ellipse $x = a \cos \theta$, $y = b \sin \theta$ is $(ax)^{2/3} + (by)^{2/3} = (a^2 - b^2)^{2/3}$ (6)

   c) Draw a sketch of the graph of the four leaved rose $r = 4 \cos 2\theta$ (6)

7. a) Find (r, θ) if r>0 and $0 \leq \theta < 2\pi$ for the point whose rectangular Cartesian coordinate representation is $(-\sqrt{3}, -1)$ (6)

   b) Draw a Sketch of the graph of function $r = -3 + 2\sin\theta$ (6)

   c) Find the coordinates of the centre of curvature at the point (x, y) of the parabola $y^2 = 4ax$ and hence find its evolute. (6)

UNIT-IV

8. a) If the function f is continuous on the closed interval $[a, b]$ and g is a function such that $g'(x) = f(x)$ for all x in $[a, b]$ then prove that $\int_a^b f(t)dt = g(b) - g(a)$ (6)

   b) Derive reduction formula for $\int_0^{\pi/2} \cos^n x \, dx$ (6)

   c) Obtain reduction formula for $\int x^m (\log x)^n dx$ and hence evaluate $\int x^4 (\log x)^2 dx$ (6)

9. a) If the function f is continuous on the closed interval $[a, b]$ then prove that there exists a number χ in $[a, b]$ such that $\int_a^b f(x)dx = f(\chi)(b - a)$. (6)

   b) If $f(x) = 10 - x^2$ with $\frac{1}{4} \leq x \leq 3$, find the Riemann sum for the function f on $\left[\frac{1}{4}, 3\right]$

   for the partition $\Delta : x_0 = \frac{1}{4}$, $x_1 = 1$, $x_2 = 1\frac{1}{2}$, $x_3 = 1\frac{3}{4}$, $x_4 = 2\frac{1}{4}$, $x_5 = 3$

   and $\quad\quad\quad \xi_1 = \frac{1}{2}$, $\xi_2 = 1\frac{1}{4}$, $\xi_3 = 1\frac{3}{4}$, $\xi_4 = 2$, $\xi_5 = 2\frac{3}{4}$ (6)

   c) Find reduction formula for $\int \sin^p x \cos^q x \, dx$, where p and q are positive integers. (6)

UNIT-V

10. a) Find the volume of the solid generated by revolving about the $x = -4$, the region bounded by the two parabolas $x = y - y^2$ and $x = y^2 - 3$ (6)

   b) Find the area of the region enclosed by one loop of the graph of the equation $r = 3\cos 2\theta$ (6)

   c) Find the length of the arc of the curve $y^3 = 8x^2$ from the point $(1,2)$ to the point $(27,18)$ (6)

11. a) The region bounded by $y = x^3$, the $x - axis$ axis and the line $x = 2$ is revolved about the x-axis. Find the volume of the solid by taking rectangular elements parallel to the axis of revolution. (6)

   b) Find the area of the region inside the circle r= $3\sin\theta$ and outside the limacon r=$2-\sin\theta$. (6)

   c) Find the volume of the solid generated by revolving about the line $x = 1$, the region bounded by the curve $(x-1)^2 = 20 - 4y$ and the lines $x = 1$, $y = 1$ and $y = 3$ and to the right $x = 1$ (6)

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MAT101.2   Reg. No. ....

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
MATHEMATICS
PAPER I: CALCULUS AND NUMBER THEORY
Duration: 3 hours   Max Marks: 120

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
      2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A   10x3=30

1. a) Find the critical numbers of the function $f(x) = x^4 + \frac{4}{3}x^3 - 4x^2$

    b) Find the value of c satisfying Rolle's Theorem for the function $f(x) = 4x^3 - 9x$ in the
        interval $\left[-\frac{3}{2}, \frac{3}{2} \right]$

    c) Prove that $f(x) = x^{2/3}$ has no relative extrema.

    d) Find $\lim\limits_{x \to +\infty} \frac{3x+4}{\sqrt{2x^2-5}}$

    e) Find vertical and horizontal asymptotes, if any, of the function $h(x) = \frac{x^2+3}{x-1}$

    f) Find a polar equation of the graph whose Cartesian equation is $x^2 + y^2 - 4x = 0$

    g) Evaluate $\int_0^{\pi/2} \cos^8 x \, dx$

    h) Find the value of χ for the function $f(x) = 3 - \frac{3x}{2}$ such that $\int_0^2 f(t)dt = f(\chi)(2-0)$

    i) Derive the reduction formula for $\int x^m (\log x)^n \, dx$

    j) Find the length of the curve $y = (x^2 + 2)^{3/2}$ from $x = 0$ to $x = 3$

    k) The region bounded by the curve $y = x^2$, the x axis and the line $x = 2$ is revolved about y
        axis. Find the volume of the solid generated.

    l) Find the area of the region enclosed by the graph of the equation $r = \theta$ from $\theta = 0$ to
        $\theta = \frac{3\pi}{2}$

    m) Prove that if $a|c$ and $b|c$ and $gcd(a,b) = 1$ then $ab|c$

    n) If $a = bq + r$ then prove that $gcd(a,b) = gcd(b,r)$

    o) Find whether the Diophantine equation $6x + 51y = 22$ has solution or not.

PART - B

UNIT-I

2. a) State and prove Cauchy's Mean Value Theorem. (6)

   b) If $f(x) = (1-2x)^3$ find the point of inflection of the graph of f and determine where the graph is concave upward and where the graph is concave downward. (6)

   c) Given $f(x) = x^3 - 6x^2 + 9x + 1$ find the relative extrema of f by applying first derivative test. Determine the intervals on which f is increasing and decreasing. (6)

3. a) Let f be a function that is differentiable on some open interval containing c then prove that

   i) if $f''(c) > 0$ the graph of f is concave upward at $(c, f(c))$

   ii) If $f''(c) < 0$ the graph of f is concave downward at $(c, f(c))$ (6)

   b) A rectangular field is to be fenced off along the bank of a river, no fence is required along the river. If the material for the fence costs $8 per running foot for the two ends and $12 per running foot for the side parallel to the river, find the dimensions of the field of largest possible area that can be enclosed with $3600 worth of fence. (6)

   c) Find point c satisfying mean value theorem for $f(x) = x^3 + x^2 - x$ in $[-2, 1]$ (6)

UNIT-II

4. a) State and prove Cauchy's mean value theorem. (6)

   b) Draw the graph of $f(x) = \dfrac{x^2}{x^2 - 4}$ (6)

   c) Evaluate $\displaystyle\lim_{x \to 0^+} (x+1)^{\cot x}$ if it exists. (6)

5. a) If $f(a) = g(a) = 0$ and f and g are differentiable in an open interval I containing a and $g'(x) \neq 0$ in I for $x \neq a$, then prove that $\displaystyle\lim_{x \to a} \frac{f(x)}{g(x)} = \lim_{x \to a} \frac{f'(x)}{g'(x)}$ (6)

   b) Derive Taylor polynomial of degree 3 for $f(x) = x^{3/2}$ at $a = 4$. (6)

   c) Sketch the graph of $r = 3 + 2\sin\theta$ (6)

UNIT-III

6. a) Find the exact value of $\displaystyle\int_1^3 x^2 dx$ as a limit of Reimann sum with regular partitions and for suitable choice of ξ_i (6)

b) If the function f is continuous on the closed interval $[a,b]$ and x is any number in $[a,b]$.
and if F is the function defined by $F(x) = \int_a^x f(t)dt$ then prove that $F'(x) = f(x)$ (6)

c) Estimate $\int_0^3 \frac{1}{9+x^2}dx$ using Trapezoidal rule for $n=6$ (6)

7. a) Derive reduction formula for $\int \sec^m xdx$, $m \geq 2$ and hence find $\int \sec^5 xdx$ (6)

b) Evaluate $\int \frac{\sqrt{x}\,dx}{1+\sqrt[3]{x}}$ (6)

c) If f is continuous on $[a,b]$ and let g be a function such that $g'(x) = f(x)$ for all x in $[a,b]$ then prove that $\int_a^b f(t)dt = g(b) - g(a)$ (6)

UNIT-IV

8. a) Find the volume of the solid generated by revolving about the line x=1 the region bounded by the curve $(x-1)^2 = 20-4y$ and the lines $x=1, y=1$ and $y=3$ and to the right of $x=1$ (6)

b) Find the area of the region enclosed by the graph of $r=3\cos\theta$ (6)

c) Find the length of the arc of the curve $x^{2/3} + y^{2/3} = 1$ in the first quadrant from the point $x = \frac{1}{8}$ to x=1 (6)

9. a) Find the volume of the solid generated by revolving about the line $y=2$, the region bounded by the curve $y = \sqrt{x}$, the x axis and the line $x=4$ (6)

b) If C is a curve defined by $y = f(x)$ where f and f' are continuous on $[a,b]$ then prove that the length of the curve from $x=a$ to $x=b$ is given by $L = \int_a^b \sqrt{1+(f'(x))^2}\,dx$ (6)

c) Find the area of the region inside the circle $r=3\sin\theta$ and outside the limacon $r=2-\sin\theta$ (6)

UNIT-V

10. a) State and prove division algorithm. (6)

b) Use Euclidean algorithm to obtain integers x and y satisfying:
$gcd(12378, 3054) = 12378x + 3054y$ (6)

c) Solve the Linear Diophantine equation $172x + 20y = 1000$ (6)

11. a) Prove that a linear Diophantine equation $ax + by = c$ has a solution if and only if $d \mid c$ Where $d = gcd(a,b)$. If (x_0, y_0) is any particular solution of this equation, then prove that all the other solutions are given by $x = x_0 + \left(\dfrac{b}{d}\right)t$ and $y = y_0 - \left(\dfrac{a}{d}\right)t$ for varying integer t. (6)

b) Let a and b be integers not both zero. Then prove that a and b are relatively prime if and only if there exist integers x and y such that $ax + by = 1$ (6)

c) If a cock is worth 5 coins, a hen 3 coins and 3 chicks together 1 coin, then how many cocks, hens and chicks totaling 100 can be bought for 100 coins? (6)

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18MAT301   Reg. No. ....

CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
MATHEMATICS
PAPER III: FUNCTIONS OF SEVERAL VARIABLES, MULTIPLE INTEGRALS AND
NUMBER THEORY

Duration: 3 hours   Max Marks: 120

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
       2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A   10x3=30

1. a) If $f(t) = \ln t$ and $g(x,y) = x^2 + y$, find the domain of fog.

    b) Find $\displaystyle \lim_{(x,y) \to (0,0)} \frac{xy}{x^2 + y^2}$ if it exists.

    c) Find the slope of the tangent line to the curve of intersection of the surface
        $z = \frac{1}{2}\sqrt{24 - x^2 - 2y^2}$ with the plane $y = 2$ at the point $\left(2, 2, \sqrt{3}\right)$.

    d) If $f(x,y) = \frac{1}{16}x^2 + \frac{1}{9}y^2$ find the gradient of 'f' at the point (4,3).

    e) Find an equation of the tangent plane to the elliptic paraboloid $4x^2 + y^2 - 16z = 0$ at the point (2,4,2)

    f) Find the critical points of $f(x,y) = x^3 + y^2 - 6x^2 + y - 1$

    g) Evaluate $\displaystyle \int_1^2 \int_0^{2x} xy^3 \, dy \, dx$

    h) Evaluate the double integral $\displaystyle \iint_R e^{-(x^2+y^2)} dA$, where the region R is in the first quadrant and bounded by the circle $x^2 + y^2 = a^2$ and the co-ordinate axes.

    i) Find the area of the surface cut from the plane $2x + y + z = 4$ by the planes $x = 0$, $x = 1$, $y = 0$, $y = 1$

    j) Evaluate $\displaystyle \int_0^1 \int_0^x \int_0^{x+y} (x+y+z) \, dz \, dy \, dx$

    k) Evaluate the iterated integral $\displaystyle \int_0^\pi \int_2^4 \int_0^1 re^z \, dz \, dr \, d\theta$

    l) Evaluate the line integral $\displaystyle \int_C (x^2 + xy)dx + (y^2 - xy)dy$, C: The line $y = x$ from the origin to the point (2,2).

    m) Show that 41 divides $2^{20} - 1$

n) If $P(x) = \sum_{K=0}^{m} C_K x^K$ be a polynomial function of x with integral coefficients C_K.

If $a \equiv b \pmod{n}$ then prove that $P(a) \equiv P(b) \pmod{n}$

o) Solve the Linear congruence $18x \equiv 30 \pmod{42}$

PART - B

UNIT-I

2. a) Prove that $\lim\limits_{(x,y) \to (1,3)} (2x+3y) = 11$ by applying $\epsilon-\delta$ definition. (6)

b) Let the function f be defined by $f(x,y) = \begin{cases} x^2 + y^2 & \text{if } x^2 + y^2 \leq 1 \\ 0 & \text{if } x^2 + y^2 > 1 \end{cases}$

Discuss the continuity of f (6)

c) Find the total derivative $\dfrac{du}{dt}$ by two methods:

i) use the chain rule   ii) Make the substitution for x and y before differentiating.

$u = ye^x + xe^y; \quad x = \cos t; \quad y = \sin t$ (6)

3. a) If $f(x,y) = \dfrac{3x^2 y}{x^2 + y^2}$ find $\lim\limits_{(x,y) \to (0,0)} f(x,y)$ if it exists by applying $\epsilon-\delta$ definition

of limit. (6)

b) If $u = x^2 + xy; \quad x = r^2 + s^2; \quad y = 3r - 2s$, find $\dfrac{\partial u}{\partial r}$ and $\dfrac{\partial u}{\partial s}$ (6)

c) If $f(x,y) = 2x^3 y + 5x^2 y^2 - 3xy^2$, find $f_{121}(x,y)$ and $f_{211}(x,y)$ (6)

UNIT-II

4. a) If $V(x,y)$ volts is the electric potential at any point (x,y,z) in three dimensional space and

$V(x,y,z) = \dfrac{1}{\sqrt{x^2 + y^2 + z^2}}$, find the rate of change of V at the point $(2,2,-1)$ in the

direction of the vector $2i - 3j + 6k$. (6)

b) If $f(x,y,z) = \cos xy + \sin yz$ find the rate of change of $f(x,y,z)$ at $(2,0,-3)$ in the

direction of the vector $-\dfrac{1}{3}i + \dfrac{2}{3}j + \dfrac{2}{3}k$ (6)

c) Find an equation of the tangent plane and equation of the normal line to the surface

$x^2 + y^2 - 3z = 2$ at the point $(-2,-4,6)$ (6)

5. a) Find the value of the directional derivative at the particular point P_0 for the given

function in the direction of U: $f(x,y) = x^2 - 2xy^2$; $U = \cos \pi i + \sin \pi j$; $P_0 = (1,-2)$ (6)

b) Find symmetric equations of the tangent line to the curve of intersection of the surfaces $3x^2 + 2y^2 + z^2 = 49$ and $x^2 + y^2 - 2z^2 = 10$ at the point $(3,-3,2)$ (6)

c) If $f(x,y) = 2x^4 + y^2 - x^2 - 2y$ determine the relative extrema of f if there are any. (6)

UNIT-III

6. a) Find an approximate value of the double integral $\iint\limits_{R} (2x^2 - 3y)\, dA$ where R is rectangular region having vertices $(-1,1)$ and $(2,3)$. Take a partition of R formed by the lines $x = 0$, $x = 1$ and $y = 2$ and taken (ξ_i, γ_i) at the centre of the ith sub region. (6)

b) Find by double integration the area of the region inside the cardioid $r = 2(1 + \sin\theta)$ (6)

c) Find the area of the paraboloid $z = x^2 + y^2$ below the plane $z = 4$. (6)

7. a) Find the volume of the solid bounded by the surface $f(x,y) = 4 - \dfrac{1}{9}x^2 - \dfrac{1}{16}y^2$, the planes $x = 3$ and $y = 2$ and the co-ordinate planes. (6)

b) Find the volume of the solid in the first octant bounded by the two cylinders $x^2 + y^2 = 4$ and $x^2 + z^2 = 4$. (6)

c) Find the area of the top half of the sphere $x^2 + y^2 + z^2 = a^2$. (6)

UNIT-IV

8. a) Evaluate $\iiint\limits_{S} xy \sin yz\, dz\, dy\, dx$ if S is the rectangular parallelepiped bounded by the planes $x = \pi$, $y = \dfrac{1}{2}\pi$, $z = \dfrac{1}{3}\pi$ and the co-ordinate planes. (6)

b) Evaluate the iterated integral $\displaystyle\int_{0}^{\pi/4} \int_{0}^{2a\cos\phi} \int_{0}^{2\pi} p^2 \sin\phi\, d\theta\, d\rho\, d\phi$ (6)

c) A particle traverses the twisted cubic $R(t) = ti + t^2 j + t^3 k$, $0 \le t \le 1$. Find the total work done if the motion is caused by the force field $F(x,y,z) = e^x i + xe^z j + x\sin\pi y^2 k$. Assume that the arc is measured in meters and the force is measured in newtons. (6)

9. a) Evaluate the iterated integral $\int\limits_0^{\pi/2} \int\limits_z^{\pi/2} \int\limits_0^{xz} \cos\frac{y}{z} \, dy \, dx \, dz$ (6)

   b) A homogeneous solid in the shape of a right circular cylinder has a radius of 2m and an attitude of 4m. Find the moment of inertia of the solid with respect to its axis. (6)

   c) Evaluate the line integral $\int\limits_C F.dR$, where

   $F(x,y) = 2xyi + (x-2y)j; \quad C : R(t) = \sin ti - 2\cos tj, \quad 0 \le t \le \pi$ (6)

UNIT-V

10. a) Prove that $a \equiv b \,(\text{mod } n)$ if and only if a and b leave the same remainder when divided by n. (6)

    b) Let $N = a_m 10^m + a_{m-1} 10^{m-1} + ... + a_1 10 + a_0$ be the decimal representation of positive integer N, $0 \le a_k < 10$ and $S = a_0 + a_1 + a_2 + ... + a_m$. Prove that $9 \mid N$ if and only if $9 \mid S$ (6)

    c) Find a solution of the simultaneous congruences

    $x \equiv 1 (\text{mod } 3),$
    $x \equiv 2 (\text{mod } 5),$ (6)
    $x \equiv 3 (\text{mod } 7)$

11. a) Prove that every positive integer $n > 1$ can be expressed as a product of primes, this representation is unique, apart from the order in which the factors occur. (6)

    b) Prove that the linear congruence $ax \equiv b(\text{mod } n)$ has a solution if and only if $d \mid b$ where $d = \gcd(a,n)$. If $d \mid b$ prove that it has 'd' mutually incongruent solutions modulo 'n'. (6)

    c) State and prove Chinese remainder theorem. (6)

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CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
MATHEMATICS
PAPER III: FUNCTIONS OF SEVERAL VARIABLES, MULTIPLE INTEGRALS AND
GROUP THEORY

Duration: 3 hours   Max Marks: 120

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
       2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A   10x3=30

1. a) Find the domain of $f(x,y) = \dfrac{1}{\sqrt{25 - x^2 - y^2}}$

    b) If $f(x,y,z) = \sin(xy + 2z)$ find $D_{132} f(x,y,z)$

    c) Find the rate of change of $f(x,y,z) = 3x^2 + xy - 2y^2 - yz + z^2$ at $(1, -2, -1)$ in the direction of the vector $2i - 2j - k$

    d) Find the volume of the solid in the first octant bounded by the cone $z = r$ and the cylinder $r = 3\sin\theta$

    e) Evaluate $\displaystyle\int_1^2 \int_0^{2x} xy^3 \, dy \, dx$

    f) Find the area of the surface that is cut from plane $2x + y + z = 4$ by the planes $x = 0$, $x = 1$, $y = 0$ and $y = 1$.

    g) Evaluate the line integral over the given curve
        $\displaystyle\int_C F.dR; \quad F(x,y) = yi + xj; \quad C: R(t) = ti + t^2 j; \quad 0 \le t \le 1$

    h) Evaluate the iterated integral $\displaystyle\int_0^{\pi/4} \int_0^a \int_0^{r\cos\theta} r \sec^3\theta \, dz \, dr \, d\theta$

    i) Evaluate $\displaystyle\int_0^1 \int_0^{1-x} \int_{2y}^{1+y^2} x \, dz \, dy \, dx$

    j) If H and K are subgroups of G and $O(H) > \sqrt{O(G)}, \quad O(K) > \sqrt{O(G)}$, Prove that $H \cap K \ne (e)$

    k) If G is the group of integers and H is the subgroup 3Z then write all the left cosets of H in G.

    l) Express $\begin{pmatrix} 1\,2\,3\,4\,5\,6\,7\,8\,9 \\ 2\,3\,4\,5\,1\,6\,7\,9\,8 \end{pmatrix}$ as a product of disjoint cycles.

    m) Prove that every subgroup of an abelian group is normal.

n) Show that the mapping $\phi : G \to G$ is defined by $\phi(x) = 2x$, $x \in G$ is a homomorphism, where G is the group of integers under addition.

o) If ϕ is a homomorphism of G into $\overline{G}$ with Kernel K then prove that K is a subgroup of G.

PART - B
UNIT-I

2: a) If $u = x^2 + xy$; $x = r^2 + s^2$; $y = 3r - 2s$; find $\dfrac{\partial u}{\partial r}$ and $\dfrac{\partial u}{\partial s}$ using chain rule. (6)

b) Find symmetric equations of the tangent line to the curve of intersection of the surfaces $3x^2 + 2y^2 + z^2 = 49$ and $x^2 + y^2 - 2z^2 = 10$ at the point $(3, -3, 2)$ (6)

c) If $V(x, y, z)$ volts is the electric potential at any point (x, y, z) in three dimensional space and $V(x, y, z) = \dfrac{1}{\sqrt{x^2 + y^2 + z^2}}$ find

i) The rate of change of V at the point $(2, 2, -1)$ in the direction of the vector $2\hat{i} - 3\hat{j} + 6\hat{k}$
ii) The direction of the greatest rate of change of V at $(2, 2, -1)$ (6)

3. a) By using $\varepsilon - \partial$ definition, prove that $\displaystyle\lim_{(x, y) \to (3, 2)} (3x - 4y) = 1$ (6)

b) If $f(x, y) = 2x^4 + y^2 - x^2 - 2y$, find the relative extrema of f if there are any. (6)

c) If $f(x, y, z) = \cos(xy) + \sin(yz)$ find the rate of change of $f(x, y, z)$ at $(2, 0, -3)$ in the direction of the vector $u = -\dfrac{1}{3}\hat{i} + \dfrac{2}{3}\hat{j} + \dfrac{2}{3}\hat{k}$ (6)

UNIT-II

4. a) Using double integral find the area of the region inside the cardioid $r = 2(1 + \sin\theta)$ (6)

b) Find the volume of the solid in the first octant bounded by the two cylinders $x^2 + y^2 = 4$ and $x^2 + z^2 = 4$. (6)

c) Find an approximate value of the double integral $\displaystyle\iint_R (xy + 3y^2) dA$, Where R is the rectangular region having vertices $(-2, 0)$ and $(4, 6)$. Take a partition of R formed by the lines $x_1 = 0$, $x_2 = 2$ and $y_1 = 2$, $y_2 = 4$ (6)

5. a) Evaluate the double integral $\displaystyle\iint_R e^{-(x^2 + y^2)} dA$, where the region R is in the first quadrant and bounded by the circle $x^2 + y^2 = a^2$ and the coordinate axes. (6)

b) Find the area of the paraboloid $z = x^2 + y^2$ below the plane $z = 4$ (6)

c) Find the volume of the solid bounded by the surface $f(x,y) = 4 - \dfrac{1}{9}x^2 - \dfrac{1}{16}y^2$, the planes $x = 3$ and $y = 2$ and the coordinate planes.   (6)

UNIT-III

6. a) Evaluate the triple integral $\displaystyle\iiint_S x\,y\sin yz\,dv$, if S is the rectangular parallelepiped bounded by the plane $x = \pi$, $y = \dfrac{\pi}{2}$, $z = \dfrac{\pi}{3}$ and the coordinate planes.   (6)

b) Find the volume of the solid bounded by the paraboloid $x^2 + y^2 = 1$ and the plane $z = x$ using cylindrical co-ordinates.   (6)

c) Evaluate the line integral $\displaystyle\int_C 3x\,dx + 2xy\,dy + z\,dz$, if the curve C is the circular helix defined by the parametric equation $x = \cos t$, $y = \sin t$, $z = t$, $0 \le t \le 2\pi$ ((6)

7. a) Evaluate $\displaystyle\int_0^{\pi/4}\int_0^{2a\cos\phi}\int_0^{2\pi} \rho^2 \sin\phi\,d\theta\,d\rho\,d\phi$ (6)

b) Find the volume of the solid bounded by the cylinder $x^2 + y^2 = 25$, the plane $x + y + z = 8$ and xy plane, using triple integrals.   (6)

c) A homogeneous solid in the shape of a right circular cylinder has a radius of 2m and an altitude of 4m. Find the moment of inertia of the solid with respect to its axis.   (6)

UNIT-IV

8. a) H and K are two subgroups of G. Prove that if HK is a subgroup of G then $HK = KH$ (6)

b) State and prove Lagrange's theorem for groups.   (6)

c) If H and K are finite subgroups of G of orders O(H) and O(K) respectively, prove that
$$O(HK) = \frac{O(H)O(K)}{O(H \cap K)}$$
     (6)

9. a) If H is a non-empty finite subset of a group G and H is closed under multiplication, then H is a subgroup of G.   (6)

b) Show that every permutation is the product of its disjoint cycles.   (6)

c) Let G be a group and H be a subgroup of G. For all $a \in G$, Prove that $Ha = \{x \in G \mid a = x(\bmod H)\}$.   (6)

UNIT-V

10. a) Define center of a group. Prove that centre of a group is a normal subgroup of G. (6)

    b) If ϕ is a homomorphism of G onto $\overline{G}$, with Kernel K, prove that G/K is isomorphic to $\overline{G}$

                                                             (6)

    c) Prove that the set of all automorphisms of a group G is a group. (6)

11. a) Prove that a subgroup N of a group G is a normal subgroup of G if and only if
$gNg^{-1} = N$ for every $g \in G$ (6)

    b) Define homomorphism of groups. If ϕ is a homomorphism of G into $\overline{G}$ then prove that
i) $\phi(e) = \overline{e}$
ii) $\phi(x^{-1}) = (\phi(x))^{-1} \quad \forall x \in G$ (6)

    c) Prove that a homomorphism ϕ of G into $\overline{G}$ with kernel K is an isomorphism if and
only if $K = \{e\}$ (6)

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MAT 502.1   Reg. No. ....

Duration: 3 hours   Max Marks: 120

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
       2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A   10x3=30

1. a) Show that $2^n > n^3$ for $n \geq 10$.

    b) If the probabilities of A and B are 0.392 and 0.515 respectively and the probability of
        $A \cap B$ is 0.090, find $p(A \cup B)$ and $p(^A|_B)$.

    c) Let f, g, h be functions from N to N defined by $f(x) = x+1$, $g(x) = x^2$ and $h(x) = 2x$.
        Determine $f \circ g \circ h$, $h \circ f$ and $f \circ f$

    d) Define the terms path and circuit in a graph with example.

    e) When are two graphs said to be isomorphic? Give an example.

    f) Define planar graph. Give an example for a nonplanar graph.

    g) Define tree. Show that there is a unique path between every two vertices in a tree.

    h) Prove that a cut set and any spanning tree must have at least one edge in common.

    i) Define ordered tree with an example.

    j) Analyse the time completely of the algorithm LARGEST1

    k) Prove that two states are in the same block in π_K if and only if they are in the same block in π_{K-1} and
        for any input letter, their successors are in the same block in π_{K-1}.

    l) Define tractable and intractable problems with examples.

    m) If $A(z) = 3z + \dfrac{2}{1-2z}$, find a_r.

    n) Find the particular solution for $a_r = a_{r-1} + 7$

    o) Prove that the numeric function $a = \alpha_0 + \alpha_1 r + \alpha_2 r^2 + ... + \alpha_n r^n$ is $O(r^n)$

PART – B

UNIT–I

2. a) Determine the number of integers between 1 and 250 which are divisible by any of the
        integers 2, 3, 5 and 7   (6)

    b) In how many ways can a group of 8 people be divided into committees subject to the
        constraint that each person must belong to exactly one committee and each committee
        must contain at least 2 people.   (6)

    c) If the length of the longest chain in a partially ordered set P is n, then show that the
        elements in P can be partitioned into n disjoint antichains.   (6)

3. a) Provide a step-by-step derivation of the sentence $C = A + D * (D + B)$ using following set of productions. (9)

$$
\begin{aligned}
\text{Asgn\_stat} &\rightarrow \text{id} = \text{exp} \\
\text{exp} &\rightarrow \text{exp} + \text{term} \\
\text{exp} &\rightarrow \text{term} \\
\text{term} &\rightarrow \text{term} * \text{factor} \\
\text{term} &\rightarrow \text{factor} \\
\text{factor} &\rightarrow (\text{exp}) \\
\text{factor} &\rightarrow \text{id} \\
\text{id} &\rightarrow A \\
\text{id} &\rightarrow B \\
\text{id} &\rightarrow C \\
\text{id} &\rightarrow D
\end{aligned}
$$

b) Prove that $\dfrac{\omega}{\omega_0} \leq \dfrac{3}{2}$ where ω is the total elapsed time and ω_0 is the minimum possible total elapsed time for a given set of tasks. (9)

UNIT–II

4. a) Prove that an undirected graph possesses an eulerian path if and only if it is connected and has either zero or two vertices of odd degree. (9)

b) Let G be a linear graph with n vertices. If the sum of the degrees for each pair of vertices in G is not less than n–1, show that there exists a Hamiltonian path in G. (9)

5. a) For any connected planar graph, prove with usual notations that $v - e + r = 2$ and hence prove that in any connected linear planar graph that has no loops and has two or more edges, $e \leq 3v - 6$ (9)

b) Prove that there is always a Hamiltonian path in a directed complete graph (9)

UNIT–III

6. a) Prove that the number of vertices is one more than the number of edges in a tree. (6)

b) Draw a binary tree for the prefix code $\{1, 01, 000, 001\}$ (6)

c) Prove that every circuit has even number of edges in common with every cutset. (6)

7. a) Write an algorithm to determine a minimum spanning tree of a connected weighted graph. Applying it, obtain a minimum spanning tree for (9)
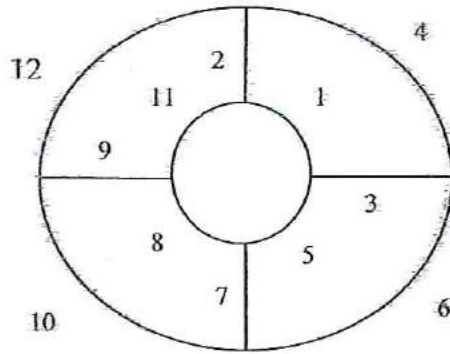
b) Define the terms i) Fundamental circuit
   ii) Fundamental cutset
   For the graph G given, write all the fundamental circuits and fundamental cutsets with respect to the spanning tree $T = \{a, b, c, d\}$

G

(9)
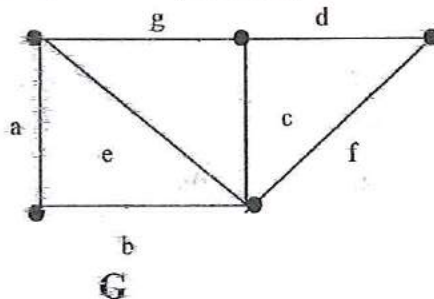
UNIT–IV

8. a) State the algorithm BUBBLESORT used to sort the n numbers stored in n registers. Also analyze its time complexity. (9)

b) Find the shortest path between a & z in the following graph. (9)
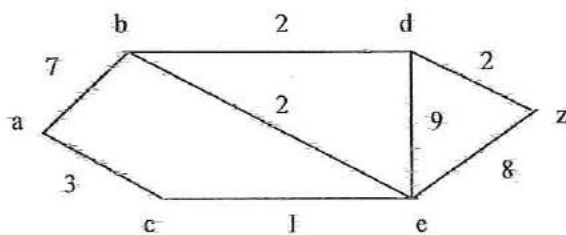
9. a) State the algorithm LARGEST1 for finding the largest of n numbers. Justify it with a formal proof (9)

b) Show that the language $L = \{a^k b^k \mid k \geq 1\}$ is not a finite state language (9)

10. a) Obtain the numeric function a_r corresponding to the generating function

$$A(z) = \frac{2 + 3z - 6z^2}{1 - 2z}$$

(6)

b) Obtain the particular solution for the difference equation $a_r + 5a_{r-1} + 6a_{r-2} = 3r^2 - 2r + 1$

(6)

c) Find the homogeneous solution of the difference equation $a_r + 6a_{r-1} + 12a_{r-2} + 8a_{r-3} = 0$

(6)

11. a) Find the particular solution of $a_r - 4a_{r-1} + 4a_{r-2} = (r+1)2^r$

(9)

b) Obtain the particular solution for the difference equation $a_r - 5a_{r-1} + 6a_{r-2} = 2^r + r$

(9)

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MAT 502.4   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019

MATHEMATICS

PAPER VI: LINEAR PROGRAMMING

Duration: 3 hours   Max Marks: 120

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.

       2. Answer FIVE full questions from Part B choosing ONE full question from each unit.

PART A   10x3=30

1.   a)   Define (i) a convex set in R^n (ii) an extreme point of a convex set in R^n.

      b)   State the Canonical minimization LPP represented by

x	1	2	3
y	4	5	6
-1	7	8	9
	$=t_1$	$=t_2$	$=g$

      c)   Pivot on $a_{11} = 1$ in the following canonical maximum table

x	y	-1	
1	-1	3	$=-t_1$
-2	1	2	$=-t_2$
2	-1	0	$=f$

      d)   Given the LPP below

           Maximize: $f(x_1, x_2) = x_1 + x_2$

           subject to $x_1 + 2x_2 \le 4$

                        $3x_1 + x_2 \le 6$

                        $x_1, x_2 \ge 0$ State the dual canonical minimization LPP.

      e)   Define unconstrained slack variables in a LPP.

      f)   Write the matrix reformulation of a canonical maximization LPP.

      g)   Reduce the following table of the matrix game using domination.

$$\begin{bmatrix} -1 & 0 & 2 & -2 & 0 \\ 1 & -2 & -4 & 2 & 2 \\ 0 & -1 & 1 & 1 & -1 \\ 0 & 5 & 4 & 2 & 0 \end{bmatrix}$$

      h)   Define mixed strategy and pure strategy for column player in the matrix game.

      i)   State Von-Neumann minimax theorem.

      j)   State the balanced transportation problem

      k)   Find all permutation set of zeroes in the following table of balanced assignment problem.

$$\begin{vmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{vmatrix}$$

l) Obtain two cycles in the following transportation table.

$$
\begin{array}{|ccc|}
\hline
C_{11} & C_{12} & C_{13} \\
C_{21} & C_{22} & C_{23} \\
C_{31} & C_{32} & C_{33} \\
\hline
\end{array}
$$

m) State the maximal flow network problem.

n) Define an α-path in a capacitated directed network.

o) Prove that any flow in a capacitated directed network satisfies $\sum_j \phi(v_j)=0$

PART – B   UNIT-I

2. a) An appliance company manufactures heaters and air conditioners. The production of one heater requires 2 hours in the parts division of the company and 1 hour in the assembly division of the company, the production of one air conditioner requires 1 hour in the parts division of the company and 2 hours in the assembly division of the company. The parts division is operated for at most 8 hours per day and the assembly division is operated for at most 10 hours per day. If the profit realized upon sale is $30 per heater and $50 per air conditioner, how many heaters and air conditioners should the company manufacture per day so as to maximize profits? Solve graphically.   (9)

b) Apply Simplex algorithm to the following maximum table.   (9)

$$
\begin{array}{ccc}
x & y & -1 \\
\end{array}
$$

-1	-2	-3	$= -t_1$
1	1	3	$= -t_2$
1	1	2	$= -t_3$
-2	4	0	$= f$

3. a) State the complete simplex algorithm for maximum table.   (9)

b) Solve using the simplex algorithm.   (9)

$$
\begin{array}{ccc}
x & y & -1 \\
\end{array}
$$

-1	-1	-2	$= -t_1$
1	-2	0	$= -t_2$
-2	1	1	$= -t_3$
-1	3	0	$= f$ (9)

UNIT-II

4. a) State the dual simplex algorithm for minimum table of a LPP.   (9)

b) Solve the noncanonical L.P.P.: (9)

Maximize $f(x, y, z) = x + 2y + z$

subject to $x + y + z = 6$

$x + y \leq 1$

$x, y \geq 0$

5. a) Solve the noncanonical L.P.P.: (9)

Maximize $f(x, y) = x + 3y$

subject to $x + 2y \leq 10$

$3x + y \leq 15$

$x \geq 0$

b) For any pair of feasible solutions of dual canonical LPPs prove that $g - f = SX' + YT$ (9)

UNIT-III

6. a) Solve the dual noncanonical L.P.P below: (9)

	x_1	x_2	x_3	-1	
y_1	0	-1	-1	-1	$= -0$
y_2	-1	-3	4	0	$= -t_1$
y_3	-1	2	-3	0	$= -t_2$
-1	-1	0	0	0	$= f$
	$=0$	$=s_1$	$=s_2$	$=g$	

b) Find the Von-Neumann value and optimal strategy for each player in the matrix game, with pay off matrix. (9)

$$\begin{bmatrix} -\frac{5}{3} & 0 \\ 5 & -\frac{10}{3} \end{bmatrix}$$

7. a) Solve the dual non canonical LPP (9)

	x_1	x_2	-1	
y_1	1	2	2	$= -0$
y_2	-1	-2	-2	$= -t_1$
-1	-1	-2	0	$= f$
	$=0$	$=s_2$	$=g$	

b) Find the optimal strategies for the row and column players and the Von Neumann value of the matrix game with pay off matrix

$$\begin{bmatrix} 0 & \dfrac{y}{4} \\ \dfrac{x-y}{4} & 0 \end{bmatrix}, \quad x > y$$

(9)

UNIT-IV

8. a) State the transportation algorithm. (9)

   b) Solve the assignment problem below. (9)

	J_1	J_2	J_3
P_1	8	7	10
P_2	7	7	8
P_3	8	5	7

9. a) State the Hungarian algorithm to solve a balanced assignment problem. (9)

   b) Solve the transportation problem below. (9)

2	1	2	40
9	4	7	60
1	2	9	10
50	60	30	

UNIT-V

10. a) Show that in a capacitated directed network with unique fixed source and unique fixed sink, no edges into the source and no edges out of the sink, the value of the maximum flow is less than or equal to the minimal cut capacity. (9)

    b) Solve the shortest path network problem below. (9)
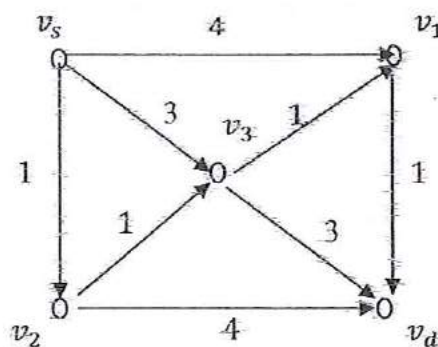
11. a) State the shortest path algorithm-I (9)

    b) Solve the maximal flow network problem below. (9)
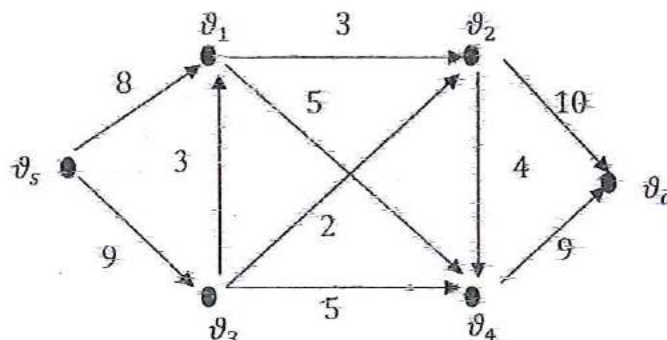
M.

19CHE E11   Reg. No. ....

Duration: 2 hours   Max marks: 40

PART A

1.   Answer any <u>Five</u> of the following: 5×2=10

   a)   State the law of chemical combination.
   b)   State Gay Lussac law of gaseous volumes.
   c)   Define gold number.
   d)   What is Tyndall effect?
   e)   Define coagulation
   f)   Define molarity.

PART-B   3x10=30
UNIT-I

Answer the following questions.

2.   a)   What are the safety rules for working in the lab?   04
   b)   Calculate the mass of sodium carbonate required to prepare $100cm^3$ of decinormal solution.   03
   c)   Calculate the volume of oxygen required to burn $500cm^3$ of methane.

OR

Calculate the number of moles in 24g of calcium carbonate.   03

UNIT-II

3.   a)   Explain the properties of gels.   04
   b)   Write a short note on protective action of colloids.   03

OR

What are emulsions? Mention its types with example.

   c)   State Hardy Schulze rule and explain with an example.   03

UNIT-III

4.   a)   Write the calibration procedure for standard flask.   04

OR

Write the calibration procedure for burette.

   b)   Write a short note on lab waste disposal.   03
   c)   What are the precaution to be taken during storing and handling chemicals. 03

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19 CHE101   Reg. No. ....

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
CHEMISTRY
PAPER I: GENERAL CHEMISTRY

Duration: 3 hours   Max marks: 80
                              PART A
1.   Answer any <u>TEN</u> of the following: 10×2=20

   a)   What are biochemicals ? Give an example.
   b)   Arrange the following in the increasing order of their ionic radii
        $Rb^+, Na^+, Cs^+ K^+$.
   c)   Define electron affinity.
   d)   Write the balanced chemical equation for the complete combustion of ethanol.
   e)   Why hydrogen and helium show heating effect on adiabatic expansion?
   f)   Carnot engine operating between the temperature T and 400K ($T > 400$) has
        efficiency of 25%. What is the temperature of the source?
   g)   State second law of thermodynamics in terms of entropy.
   h)   Give an expression for Joule-Thomson coefficient and explain the terms.
   i)   What are benzynes? Name the reaction involving benzyne.
   j)   Which is the most stable conformation of cylo hexane and why?
   k)   What are cumulated dienes? Give one example.
   l)   Give one example each for benzenoid and non benzenoid compounds.

                              PART-B
                              UNIT-I
Answer any <u>TWO</u> of the following.   2×10=20

2.   a)   How is ionic radius determined by Lande's method?   04
     b)   Balance the following. $MnO_4^- + SO_3^{2-} \rightarrow MnO_4^{2-} + SO_4^{2-}$.   03
     c)   Explain the classification of chemicals with suitable method. 03

3.   a)   How does ionization energy vary in the periodic table? How is it determined
          by discharge tube method?   04
     b)   Write the chemical formula of   i) Potassium nitride
          ii) Sodium Sulphite   iii) Aluminium phosphate   03
     c)   How is electro negativity useful in predicting type of bonds and bond angle?03

4.   a)   Discuss the trend in the periodic table with respect to acidic and basic
          properties of elements.   04
     b)   What are the factors affecting the ionization energy of an element?   03
     c)   Explain Born-Haber cycle for the formation of an ionic bond.   03

UNIT-II

Answer any **TWO** of the following.   2×10=20

5. a) Derive an expression for efficiency of a heat engine in terms of temperature of the source and sink.   04

    b) Show that Joule-Thomson effect is an isoenthalpic process.   03

    c) Calculate the free energy change which occurs when one mole of an ideal gas expands reversibly and isothermally and 300k from initial volume of 5 litres to 50 litres.   03

6. a) Derive an expression for variation of entropy with volume and temperature. 04

    b) Explain Kelvin scale of temperature.   03

    c) Derive an expression for work done by ideal gas during reversible adiabatic expansion.   03

7. a) The heat of a reaction for $N_2 + 3H_2 \rightarrow 2NH_3$ at 27°C was found to be $-91.94kJ$. Calculate the heat of a reaction at 50°C. The molar heat capacities at constant pressure at 27°C for nitrogen, hydrogen and ammonia are 28.45, 28.32 and 37.07 J|k|mol respectively.   04

    b) Derive Gibb's – Helmholtz equation.   03

    c) Define the term   i) Inversion temperature

                          ii) Heat capacity at constant volume.   03

UNIT-III

Answer any **TWO** of the following.   2×10=20

8. a) Explain the mechanism of Hoffmann rearrangement.   04

    b) How is the stability of higher cyclo alkanes explained on the basis of Sasche-Mohr theory?   03

    c) Write the differences between inductive and electromeric effect. 03

9. a) What are carbocations?   Give the mechanism of a reaction involving carbocation.   04

    b) Calculate the angle strain in cyclopentane.   03

    c) Give any two methods for the preparation of 1, 3 – butadiene.   03

10. a) Explain the mechanism of addition of HBr to 1, 3 – butadiene.   04

    b) What are the criteria for aromaticity? Explain with suitable examples. 03

    c) Write the limitation of Bayer strain theory.   03

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Reg. No. ....

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
CHEMISTRY
PAPER I: GENERAL CHEMISTRY
Duration: 3 hours   Max marks: 80
PART A

1. Answer any __TEN__ of the following: $10 \times 2 = 20$

    a) Give two sources of chemical compounds.

    b) How does electronegativity vary in the periodic table?

    c) Distinguish between element and compound.

    d) Between cation and anion which is larger and why?

    e) Define inversion temperature. Give a mathematical expression for it.

    f) Give the expression for work done during an isothermal process and adiabatic process.

    g) State second law of thermodynamics in terms of entropy.

    h) How is free energy change a criterion for spontaneity?

    i) State Huckel's rule for aromaticity.

    j) How does hyper conjugation determine the stability of carbocations?

    k) With examples define antiaromatic and nonbenzenoid aromatic compounds.

    l) What is Diels Alder reaction?

PART-B
UNIT-I

Answer any __TWO__ of the following. $2 \times 10 = 20$

2. a) Explain determination Election affinity by Born - Haber cycle   04

    b) Explain the scales used to measure electronegativity.   03

    c) With suitable examples explain different types of chemical compounds.   03

3. a) Explain the significance of the position of elements in the periodic table by comparing their properties.   04

    b) Explain the method of determination ionic radius by Lande's method.   03

    c) Balance the equation by ion electron method in the acid mediam
        $$MnO_4^- + C_2O_4^{2-} \longrightarrow Mn^{2+} + CO_2$$ 03

4. a) Explain the diagonal relationship between Li and Mg.   04

    b) Comment on the sizes of the cation and anion with respect to a neutral parent atom.   03

    c) What is ionisation energy? Explain its variation in the periodic table   03

UNIT-II

Answer any **TWO** of the following.   2×10=20

5. a) Derive Kirchoff's equation.   04
   b) Derive an expression for entropy change as a function of temperature and volume.   03
   c) A system absorbs 963 KJ of heat and does 321 KJ of work. Calculate its efficiency.   03

6. a) Derive an expression for the variation of Gibbs free energy with pressure and temperature.   04
   b) What is heat capacity? How are they related to the ideal gas constant.   03
   c) Explain Joule -Thomson expansion of a gas.   03

7. a) Derive an expression for efficiency of a Carnot engine based on Carnot cycle.   04
   b) Derive an expression for work done during reversible isothermal expansion of an ideal gas.   03
   c) What is the significance of the Kelvin scale of temperature?   03

UNIT-III

Answer any **TWO** of the following.   2×10=20

8. a) With an example explain the significance of Markownikoff's rule.   04
   b) Give the mechanism of a reaction involving carbenes   03
   c) How do you convert cyclopropane to propane and 1- bromo propane.   03

9. a) Explain stability of cycloalkanes based on angle strain.   04
   b) Give two methods to synthesize 1, 3 – butadiene.   03
   c) Write a note on Inductive effect.   03

10. a) Describe the mechanism of Hoffmann rearrangement reaction.   04
    b) Explain addition of bromine to 1, 3 – butadiene.   03
    c) Discuss the conformations in cyclohexane.   03

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CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
CHEMISTRY
PAPER III: GENERAL CHEMISTRY

Duration: 3 hours   Max marks: 80

PART A

1. Answer any <u>TEN</u> of the following: $10\times2=20$

    a) What are boranes? Give one example.

    b) Write the structure of phosphoric acid & nitrous acid.

    c) Carbon dioxide is a gas while silicon dioxide is a solid. Give reason.

    d) What are Clathrates? Give an example.

    e) State the law of constancy of interfacial angles.

    f) Define density. Write its SI unit.

    g) Write the reduced equation of state and explain the terms.

    h) A crystal has intercepts on the three axes of the crystal in the ratio of $\frac{3}{2}:2:1$ what are the Miller indices of the plane.

    i) What are cyclic ethers? Give an example.

    j) Acetaldehyde answers aldol condensation reaction while benzaldehyde does not. Justify.

    k) What happens when oxalic acid is heated?

    l) How is benzamide prepared from benzoic acid?

PART-B
UNIT-I

Answer any <u>TWO</u> of the following. $2\times10=20$

2. a) Explain the structure and bonding in diborane.   04

    b) What is inert pair effect? Give two examples to support your answer.   03

    c) Explain one method each for the preparation of XeF_6 and XeO_3.   03

3. a) What are interhalogen compounds? Give an example for each type.   04

    b) Name any three types of silicates and give their structure.   03

    c) Give an example for hydrates of noble gas and mention its applications. 03

4. a) Explain the variation of ionisation energy and oxidation state of group 14 elements.   04

    b) Write a note on different types of carbides.   03

    c) Explain the hybridization and structure of XeF_4.   03

UNIT-II

Answer any **TWO** of the following.   2×10=20

5. a) Derive the expression for critical constants T_c, V_c & P_c in terms of van der Waals constants.   04

    b) Define plane of symmetry? How many planes of symmetry are possible in a cubic crystal? What are they?   03

    c) Write any three applications of liquid crystals.   03

6. a) Explain the principle and determination of viscosity by Ostwald's Viscometer. 04

    b) What are Bravais lattices? Mention the type of Bravais lattice in a cubic crystal system.   03

    c) Explain the inter molecular forces present in liquid systems.   03

7. a) Explain the determination of crystal structure of sodium chloride by Bragg's method.   04

    b) Describe liquefaction of gas by Linde's method.   03

    c) Calculate the height to which water will rise in a glass capillary tube, if the radius of the tube is 0.02cm. The surface tension of water is $0.0728 Nm^{-1}$ and density $10^3 \, kgm^{-3}$.   03

UNIT-III

Answer any **TWO** of the following.   2×10=20

8. a) Explain the mechanism of benzoin condensation.   04

    b) How is glutaric acid prepared from Grignard reagent?   03

    c) Explain the base catalysed cleavage reactions of ethylene oxide.   03

9. a) Explain the addition reaction of Grignard reagent to aldehydes and ketones. 04

    b) Give any two methods for the preparation of acid chloride.   03

    c) Explain Williamson's ether synthesis with an example.   03

10. a) Explain the mechanism of Knovenagel condensation.   04

    b) Explain Clemmensen reduction with suitable example.   03

    c) Write any three applications of Crown ethers.   03

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CREDIT BASED THIRD2 SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER :2019
CHEMISTRY
PAPER III: GENERAL CHEMISTRY
Duration: 3 hours   Max marks: 80
PART A
1.   Answer any <u>TEN</u> of the following: 10×2=20

   a) H_2O is a liquid, while H_2S is a gas. Give reason.
   b)   Write the structures of i) Pyrophosphoric acid   ii) Nitric acid
   c)   Carbon tetrahalides do not form complexes, but tetrahalides of other elements of group 14. Why?
   d)   What are clathrates? Give an example.
   e)   What is Inversion temperature? How is it related to van der Waal's constants?
   f)   Define viscosity and write SI unit.
   g)   Define plane of symmetry and axis of symmetry of a unit cell.
   h)   Diagramatically represent the planes having miller indices (1 0 0) and (1 1 1) in a simple cubic crystal,
   i)   Explain Williamson's synthesis with an example.
   j)   Give an example for Mannich reaction.
   k)   What is HVZ reaction? Give an example.
   l)   How is benzamide prepared form benzoic acid?

PART-B
UNIT-I
Answer any <u>TWO</u> of the following.   2×10=20

2.   a)   Explain the structure and bonding in diborane.   04
     b)   Name any three types of silicates and give their structure.   03
     c)   How are the following prepared?
          i) XeF_2 ii) XeF_6 03

3.   a)   What is inert pair effect? Explain its effect on the oxidation states of group 13 elements.   04
     b)   Write a note on hydrides of group 15 elements.   03
     c)   Give an example for PtF_6 complex of noble gases and explain the method of preparation of PtF_6 complex.   03

4.   a)   Explain the structures of the following:
          i) XeF_4 ii) XeO_3 04
     b)   Write a note on different types of carbides.   03
     c)   What are interhalogen compounds? Give an example for each type. 03

UNIT-II

Answer any **TWO** of the following.   2×10=20

5. a) Explain the Andrew's Isotherm of carbon dioxide.   04
    b) Explain the principle and determination of surface tension by drop number method.   03
    c) A crystal plane has intercepted on the three axis of crystal in the ratio of 2a: 2b: 1c respectively. What are Miller Indices of the plane?   03

6. a) Explain X-ray diffraction by crystal and derive Bragg's equation.   04
    b) Explain the principle and determination of viscosity by Ostwald's Viscometer.   03
    c) Calculate the critical temperature of a gas for which critical pressure is 101325 Pascal and b is $4.15 \times 10^{-3} m^3 mol^{-1} (R = 8.314 J K^{-1} mol)$ 03

7. a) State law of corresponding state Derive the reduced equation of state for a gas.   04
    b) Explain rotating crystal technique to determine the crystal structure of sodium chloride crystal.   03
    c) How high will sap rise in a plant if the capillaries are 0.01mm in diameter, the density of the fluid is $1.3 \times 10^{-3} kgm^{-3}$ and its surface tension is $0.065 Nm^{-1}$. $(g = 9.81 ms^{-2})$.   03

UNIT-III

Answer any **TWO** of the following.   2×10=20

8. a) Explain   i) Rosenmund reduction reaction of acid chlorides.
                    ii) Hydrolysis reaction of acetic anhydride.   04
    b) Explain with suitable example the use of acetals as protecting groups.   03
    c) What are crown ethers? Write the applications of crown ethers.   03

9. a) Explain any four acid catalysed cleavage reactions of ethylene dioxide.   04
    b) Explain the mechanism of benzoin condensation.   03
    c) What is the action of heat on adipic acid and oxalic acid?   03

10. a) Explain the effect of substituents on the acidity of carboxylic acid.   04
    b) Explain the following reactions with an example.
        i) Reformatsky reaction   ii) Clemmenson reduction   03
    c) i) Write the IUPAC name of CH_3OCH_3.
        ii) How is ethylene oxide synthesised from alkenes?   03

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CHE 501.2   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
CHEMISTRY
PAPER V: GENERAL CHEMISTRY

Duration: 3 hours   Max marks: 80

PART A

1.   Answer any <u>TEN</u> of the following: 10×2=20

   a)   What is meant by eigen values?

   b)   Write the values of n.l,m and s for the last electron of sodium atom.

   c)   Write the IUPAC names of i) $Na_3[AlF_6]$ ii) $[Co(ox)_2(H_2O)_2]$ ion.

   d)   Explain why tetrahedral complexes do not show geometrical isomerism.

   e)   Mention the number of components in the reaction.

      $CaCO_3 \rightarrow CaO + CO_2$

   f)   Explain why pure gases are bivariant.

   g)   Define molar conductance. Give its S.I unit.

   h)   How do specific conductance and equivalent conductance vary with dilution?

   i)   Assign R and S configuration for the following.

$$
\begin{array}{cc}
\text{COOH} & \text{Cl} \\
| & | \\
\text{H}_3\text{C} - \text{C} - \text{OH} & \text{H} - \text{C} - \text{CH}_2\text{CH}_3 \\
| & | \\
\text{H} & \text{CH}_3
\end{array}
$$
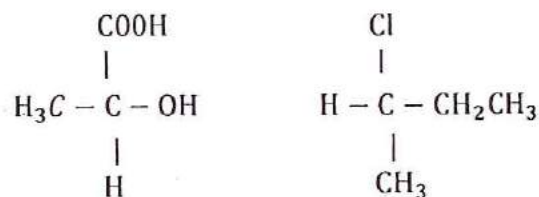
   j)   What is meant by racemisation? Give an example.

   k)   How is an aldohexose converted into aldopentose

   l)   How does glucose react with

      i) Tollen's reagent   ii) Nitric acid

PART-B
UNIT-I

Answer any <u>TWO</u> of the following.   2×10=20

2.   a)   Explain Compton effect.   03

      b)   What are the postulates of question mechanics?   03

      c)   Explain the formation of the complex $[Co(CN)_6]^{3-}$ using *VBT* and account for
            its magnetic property.   04

3.   a)   Explain geometrical isomerism in square planar complexes.   03

      b)   What are chelates? Explain with two examples.   03

      c)   Explain the physical significance of ψ and ψ^2.   04

4. a) Explain photo electric effect. 03
   b) What is the significance of quantum numbers. 03
   c) Explain optical isomerism in coordination compounds. 04

UNIT- II

Answer any **TWO** of the following. 2×10=20

5. a) Explain the determination of solubility of sparingly soluble salt by conductometry. 03
   b) Discuss the conduct metric titration curve obtained in the titration of
      i) Strong acid vs weak base   ii) $AgNO_3$ vs KCl 03
   c) Discuss the phase diagram of water system. 04

6. a) Explain the desilverisation of lead. 03
   b) At 291K the molar conductivities at infinite dilution of NH_4Cl NaOH and NaCl are 129.8×10^{-4}, 217.4×10^{-4} and 108.9×10^{-4} Sm^2 mol^{-1} respectively. If the molar conductivity of 0.01N solution of NH_4OH is 9.33×10^{-4} Sm^2 mol^{-1}. What is the percentage of dissociation of NH_4OH at this dilution? 03
   c) How is transport number of an ion determined by Hittorf's method using non attackable electrodes? 04

7. a) The speed ratio of Ag^+ to NO_3^- ion was found to be 0.916 during electrolysis of $AgNO_3$ solution. Find the transport number of Ag^+ and NO_3^- ions. 03
   b) Write a note on freezing mixtures. 03
   c) Discuss the phase diagram of magnesium –zinc system. 04

UNIT-III

Answer any **TWO** of the following. 2×10=20

8. a) What are glycosides? Give one method of preparation. 03
   b) Explain optical isomerism in tartaric acid. 03
   c) Explain the mechanism of osazone formation. 04

9. a) Describe the methods for the resolution of racemic mixture. 04
   b) Explain the geometrical isomerism in oximes. 03
   c) Explain Kiliani-Fischer synthesis with an example. 03

10. a) How is the configuration of fructose determined? 03
    b) Write a note on epimerization. 03
    c) Draw Newman projection formula for the eclipsed and staggered conformations in ethane. Which is more stable and why? 04

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CHE 502.2   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019

CHEMISTRY
PAPER VI: GENERAL CHEMISTRY

Duration: 3 hours   Max marks: 80

PART A

1. Answer any <u>TEN</u> of the following: 10x2=20

   a) Europium and Ytterium show +4 oxidation state. Give reason.

   b) Identify the compound with higher covalent character among AgCl and KCl. Justify your answer.

   c) What are actinides? Give their general electronic configuration.

   d) AgI_2^- complex is stable but AgF_2^- is not. Give reason.

   e) Which of the following molecules are micro wave active? Give reason.
      CO, CO_2, O_2 and HF

   f) Define Stokes and antiStokes lines.

   g) Calculate the zero point energy of hydrogen in joules. The fundamental frequency of hydrogen is $4000 \times 10^2 m^{-1}$ ($h = 6.626 \times 10^{-34} Js$ $c = 3 \times 10^8 m/s$)

   h) What is chemical shift in NMR?

   i) Give one method of preparation of Grignard reagent with chemical equation.

   j) Why is ethyl acetoacetate highly reactive?

   k) Give an example each for triphenylmethane dyes and phthalein dyes.

   l) How does methyl magnesium iodide react with ethanol? Write the chemical equation.

PART-B
UNIT-I

Answer any <u>TWO</u> of the following.   2x10=20

2. a) What is lanthanide contraction? Explain its cause and consequences.   04
   b) Explain the solubility of ionic solid on the basis of lattice energy.   03
   c) What are the factors affecting hardness of acids and bases.   03

3. a) Write Fajan's rules? Explain the factors that affect polarization.   04
   b) Give the comparison between lanthanides and actinides.   03
   c) Explain any three applications of HSAB principle.   03

4. a) Differentiate between conductors, semi conductors and insulators on the basis of band theory.   04
   b) Discuss the variation in oxidation states of lanthanides.   03
   c) Explain the complexation tendencies of 'f' block elements.   03

UNIT-II

Answer any <u>TWO</u> of the following.   2x10=20

5. a) How does PMR spectrum of a compound help us to elucidate the structure of a
        compound?   04
    b) What is a selection rule? Write and explain the selection rule for
        (i) Microwave transition (ii) Infra red transition.   03
    c) Explain the quantum theory of Raman spectroscopy.   03

6. a) Explain the general rules about spin-spin interaction and predict the NMR
        spectrum of ethylalcohol.   04
    b) Derive an expression for moment of inertia of a rigid diatomic rotator.   03
    c) Sketch the energy levels for a perfect harmonic oscillator for a typical diatomic
        molecule. Explain anharmonic behavior of diatomic molecules.   03

7. a) The pure rotational spectrum of HF gives a series of lines whose separation is
        $4050\ m^{-1}$. Calculate the moment of inertia and internuclear distance for the
        molecule ($N = 6.022 \times 10^{23}$, $h = 6.626 \times 10^{-34}\ Js$. Atomic mass of $H = 1$ a.m.u.
        and atomic mass of $F = 19$ a.m.u.)   04
    b) Explain the applications of IR spectra.   03
    c) Write a short note on nuclear shielding and deshielding in NMR.   03

UNIT-III

Answer any <u>TWO</u> of the following.   2x10=20

8. a) Explain the preparation of ethyl aceto acetate. Give its mechanism.   04
    b) Give one method of preparation for Aluminium isopropoxide.   03
    c) Explain the method of preparation of Fluorescein.   03

9. a) Starting from diethyl malonate, how are the following prepared?
        (i) Succinic acid   (ii) Adipic acid.   04
    b) Explain Freidel – Crafts reaction with an example.   03
    c) Give the synthesis of Congo red.   03

10. a) Explain the classification of dyes based on the structure.   04
    b) Describe Oppenauer oxidation with an example.   03
    c) Explain the acidity of C – H bond of methylene group in ethyl aceto acetate and
        diethyl malonate.   03

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19BOT101   Reg. No. ....

CHOICE BASED CREDIT SYSTEM
FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
BOTANY
PLANT DIVERSITY-I

Time: 3 Hrs   Max. Marks: 80

PART – A

1. Answer any TEN of the following.   10x2=20

    a) Expand TEM & SEM
    b) Define prophage. Where it is seen?
    c) What are bacteriophage? Give an example.
    d) Mention the contribution of d Herele and Beijerinck.
    e) Write two examples for photosynthetic bacteria with suitable examples.
    f) What are harmogones? Give an example.
    g) Give any two economic importance of bacteria with suitable examples.
    h) What is entrophication?
    i) What is evection? Give an example.
    j) What are pyrenoides?
    k) Differentiate between isogamy and anisogamy.
    l) What is triphasic life cycle? Where it is seen?

PART – B
UNIT – I

Answer any TWO of the following.   2x10=20

2. a) Give an account of phase contrast microscopes.   6
    b) Explain the structure of mycoplasma.   4

3. a) Explain the structure of TMV and symptoms of Tobacco Mosaic disease. 6
    b) Give an account of prions. Comment a disease caused by them.   4

4. a) Discuss five kingdom system of classification with suitable examples. . 6
    b) Explain bunchy top of banana.   4

UNIT – II

Answer any TWO of the following.   2x10=20

5. a) With the help of neat labelled diagram explain the structure of a bacterial cell. 6
    b) What are single cell proteins? Give suitable examples.   4

6. a) Explain the general characteristics of cyanobacteria.   6
    b) Explain the locomotion in *Euglena*.   4

7. a) Describe conjugation in bacteria. Write ifs significance.   6
    b) Explain the methods of false branching in *Scytonema.*   4

UNIT – III

Answer **any TWO** of the following.   2x10=20

8. a) Describe the asexual reproduction in *Volvox.*   6
    b) Explain the thallus structure of *Polysiphonia.*   4

9. a) Explain male and female conceptacle of *Sargassum*   6
    b) Give an account of sexual reproduction in *Vaucheria.*   4

10. a) Describe the cell structure of *Pinnularia.*   6
    b) Explain the morphological types of *Caulerpa* with suitable examples. 4

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18BOT301   Reg. No. ....

CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION
OCTOBER 2019
BOTANY
PLANT DIVERSITY-III

Time: 3 Hrs   Max. Marks: 80

PART – A

1. Answer any TEN of the following.   10x2=20

   a) What are spur shoots?
   b) Write any 4 characteristic features of Gymmosperms.
   c) Explain monoliform root. Give an example.
   d) What are phyllodes? Give an example.
   e) Write two diagnostic features of the family Anacardiaceae.
   f) What is imbricate acstivation ? Mention its types.
   g) What is APG system of classification.
   h) Mention any two International Botanical Gardens.
   i) Write the botanical names of cucumber and pumpkin.
   j) Give two examples for family Rubiaceae.
   k) Explain the gynoecium of Apocynaceae.
   l) What is gynobasic style? Where it is seen?

PART – B
UNIT – I

Answer any two of the following: 2x10=20

2. a) Describe the internal structure of *Cycas* leaflet with suitable diagram   6
    b) Explain cyathium inflorescence.   4

3. a) Explain the structure of female cone of *Pinus*.   6
    b) Write a note on any 4 types of underground stem modifications.   4

4. a) Write a note on a simple dry dehiscent fruits.   6
    b) Explain the angiospermic characters of *Gnetum*.   4

UNIT – II

Answer any two of the following: 2x10=20

5. a) Write a note on merits and demerits of Benthem & Hooker system of
        Classification.   6
    b) Write a note on papilionaceous corolla.   4

6. a) Write the distinguishing charecters of the family Malvaceae.   6
    b) Write a note on cohesion of stamens   4

P.T.O

| 7. | a) | Explain the rules of binomial nomenclature | 6 |
| | b) | Write a note on E – flora & E – herbarium. | 4 |

UNIT – III

Answer any two of the following: 2x10=20

| 8. | a) | Describe the salient features of family Amaranthaceae. | 6 |
| | b) | Explain spikelet. | 4 |

9.	a)	Write a short note on	
		a) Resupination b) Labellum c) Regma.	6
	b)	Explain the androecium is Acanthaceae.	4

| 10. | a) | Write a note on floral characters of family Asteraceae | 6 |
| | b) | Write botanical names & uses of any four examples of family Solanaceae. | 4 |

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BOT 301.2   Reg. No. ....

CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION
OCTOBER 2019
BOTANY
PLANT DIVERSITY-II

Time: 3 Hrs   Max. Marks: 80

Instructions:
1. Answer both Part A & Part B.
2. Answer two full questions from each unit.
3. All questions in Part B carry equal marks.
4. Draw diagrams wherever necessary.

PART – A

1. Answer any TEN of the following.   10x2=20
    a) Give any two distinguishing characters of family Myrtaceae.
    b) Explain verticillaster with example.
    c) Give one example each for the following
        i) Runner ii) Stolon iii) Offset iv) Sucker
    d) Mention two species of *Cycas*.
    e) What is Hypocrateriform Corolla? Give example.
    f) Explain *Pinus* Microspores.
    g) Give two examples for Orchids.
    h) What is Syngenesious stamens? Where do you find?
    i) Write note on Gynoecium of family Solanacae.
    j) Name the types of fruits in Anacardiaceae.
    k) Give Botanical names of i) Oil Palm ii) Sago
    l) What is APG III system of Classification?

PART – B
UNIT – I

Answer any TWO of the following.   2x10=20

2. a) Give an account of any four types of Racemose Inflorescences with examples.
                                                                    6
    b) Explain the *Cycas* leaflet structure with labeled diagram.   4

3. a) Give an account of Underground stem modifications for storage with examples.
                                                                    6
    b) Explain different types of Phyllotaxy with examples   4

4. a) Describe the structure of male cone of *Gnetum* with diagram.   6
    b) Give an account on corolloid root of *Cycas*.   4

UNIT – II

Answer any **TWO** of the following.   **2x10=20**

5. a) Write the diagnostic characters of the family Malvaceae. Mention any two
        examples with scientific names.   6
    b) Write a note on 1) Cruciform Corolla 2) Bilabiate Corolla
        3) Infundibuliform corolla 4) Ligulate corolla.   4

6. a) What is placentation? Explain the types.   6
    b) Describe the types of fruits in Rosaceae.   4

7. a) Give the Diagnostic characters of family Papilionaceae   6
    b) Describe Bentham & Hookers classification with merits and demerits. 4

UNIT – III

Answer any **TWO** of the following.   **2x10=20**

8. a) Give an account of the diagnostic characters of family Rubiaceae with two
        examples.   6
    b) Explain the inflorescence of Euphorbiaceae.   4

9. a) Write a note on i) Orchid flower ii) Leaves of Liliaceae   6
    b) Mention the economically important plants under the family Myrtaceae with
        common name and scientific name.   4

10. a) Write short notes on:
        1) Caryopsis
        2) Jaculators
        3) Quincuncial Aestivation
        4) Hermaphrodite Flowers
        5) Sagittate Stamens
        6) Unicostate Venation   6
    b) a) Explain Inflorescence of Poaceae
        b) Write the common name, botanical name and uses of any two
           economically important plants of Cucurbitaceae.   4

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BOT501.2   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION
OCTOBER 2019
BOTANY
PLANT PHYSIOLOGY

Time: 3 Hrs   Max. Marks: 80

Instructions:
1. Answer both Part A & Part B.
2. Answer two full questions from each unit.
3. All questions in Part B carry equal marks.
4. Draw diagrams wherever necessary.

PART – A

1. Answer any TEN of the following.   10x2=20

   a) Write two structural adaptations in plants to check excessive transpiration.
   b) What are co-enzymes? Give two examples.
   c) Define Imbibition. Give an example.
   d) Write any two properties of water.
   e) What is photolysis of water? Mention its significance.
   f) Define RQ. Why the RQ of fat is less than 1.
   g) State the law of limiting factors.
   h) Define translocation. Comment on the path of translocation in plants.
   i) What is transamination? Give an example.
   j) List any two roles played by cytokinins in plants.
   k) Write the organels involved in glyonylate cycle. Mention its significance.
   l) Write two practical applications of vernalization in agriculture.

PART – B
UNIT – I

Answer any TWO of the following.   2x10=20

2. a) Explain the K^+ ion exchange theory.   6
   b) Write the roles played by any one micronutrient in plants.   4

3. a) Give an account of enzyme inhibitors.   6
   b) Explain plasmolysis and its importance.   4

4. a) Describe the mechanism of salt absorption based on Bennet-Clarks's theory. 6
   b) $\psi = \psi_P + \psi_S$ comment on this equation.   4

UNIT – II

Answer **any TWO** of the following.   2x10=20

5.	a)	Describe Calvin cycle.	6
	b)	Define fermentation and explain its industrial uses.	4
6.	a)	Explain Glycolysis and its significane.	6
	b)	Write short note on pressure flow theory.	4
7.	a)	Explain cyclic photophosphorylation and its significance.	6
	b)	Briefly explain ETS in mitochondria.	4

UNIT – III

Answer **any TWO** of the following.   2x10=20

8.	a)	Explain β - oxidation and its significance.	6
	b)	Write the role of abscissic acid in plants.	4
9.	a)	Explain the role played by Auxins in plants growth.	6
	b)	Give an account of photoperiodic induction.	4
10.	a)	Describe the Nitrogen cycle.	6
	b)	Explain the synthesis and degradation of Glycerol.	4

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BOT 502.2   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION
OCTOBER 2019
BOTANY
MOCLECULAR BIOLOGY

Time: 3 Hrs   Max. Marks: 80

Instructions:
1. Answer both Part A & Part B.
2. Answer two full questions from each unit.
3. All questions in Part B carry equal marks.
4. Draw diagrams wherever necessary.

PART – A

1. Answer **any TEN** of the following.   10x2=20
    a) What is teminism? Name the scientist who proposed it.
    b) Define exons and introns.
    c) What is autopolyploidy? Give an example.
    d) What is frame shift mutation?
    e) What are non-sense codons? Name them.
    f) Expand PCR. Name the enzyme used in it.
    g) What are primers?
    h) What is reverse tandem duplication?
    i) State Chargaff's Rule.
    j) Mention the types of deletions.
    k) Give the names of enzymes produced in *lac operon*.
    l) Mention any two nucleic acid sequencing database.

PART – B
UNIT – I

Answer **any TWO** of the following.   2x10=20
2. a) Explain structure of t-RNA with a labelled diagram.   6
    b) Write a note on RNA polymerase.   4

3. a) Give an account of DNA replication.   6
    b) Write a note on Hershey-Chase experiment.   4

4. a) Explain Translation in Prokaryotes.   6
    b) Write a note on Plasmids.   4

UNIT – II

Answer **any TWO** of the following.   2x10=20

5. a) Discuss the cytological effects of translocation heterozygote.   6
    b) Give an account of Monosomy.   4

6. a) Write a note on *Tryptophan Operon*.   6
    b) Give an account of paracentric inversion.   4

7. a) Write a detailed note on allopolyploidy with its importance.   6
    b) Give an account of trisomy.   4

UNIT – III

Answer **any TWO** of the following.   2x10=20

8. a) Explain the technique of DNA Fingerprinting.   6
    b) Write a note on role of Radiation in Mutation.   4

9. a) Enumerate the goals, uses and applications of HGP.   6
    b) Give an account of Northern blotting.   4

10. a) Give an account of Base-Pair substitution.   6
    b) Write an account of role of mutation in Plant breeding.   4

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CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION
OCTOBER 2019
MICROBIOLOGY - I
GENERAL MICROBIOLOGY

Duration: 3 Hours   Max Marks: 80

Note: Draw diagrams wherever necessary.

PART - A

I. Answer any <u>TEN</u> of the following: 10X2=20
   a) Louis Pasteur
   b) Differential Media
   c) Frederick Twort
   d) Resolving Power
   e) Stab Culture
   f) Aldehydes
   g) Capsule
   h) Incineration
   i) Bergey's Manual
   j) Anaerobic Chamber
   k) Waksman
   l) Mixed Culture.

PART – B
UNIT - I

Answer any TWO complete questions from the following   2x10=20

II. a) Explain the branches and scope of Microbiology.   06
     b) Write a note on the criteria used for classification of bacteria.   04

III. a) Explain Whittaker's Five Kingdom Concept of Taxonomy.   06
     b) Write a note on the contributions of Khorana   04

IV. a) Discuss the contributions of Robert Koch.
         Add a note on his postulates.   06
     b) Write a note on principles of Binomial Nomenclature.   04

UNIT-II

Answer any TWO complete questions from the following   2x10=20

V.   a) Explain the working Principle and uses of bright field and dark field
         Microscope   06
     b) Write a note on compound Microscope.   04

VI. a) Explain any three chemical agents used for control of microbes.   06
     b) Write a note on hot air oven.   04

VII. a) Explain Acid Fast staining technique.   06
     b) Write a note on Schaeffer Fulton spore staining method.   04

UNIT-III

Answer any TWO complete questions from the following   2x10=20

VIII.	a)	Define culture media and explain the types of special media.	06
	b)	Discuss the characteristics of pure culture	04
IX.	a)	Explain the preservation and maintenance of pure culture.	06
	b)	Write a note on streak culture method.	04
X.	a)	Discuss serial dilution method.	06
	b)	Write a note on pre reduced media.	04

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CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION
OCTOBER 2019
MICROBIOLOGY
MICROBIAL GROWTH

Duration: 3 Hours   Max Marks: 80

Note: Draw diagrams wherever necessary.

PART - A

I.   Answer any <u>TEN</u> of the following: 10X2=20
   a) Generation Time
   b) Osmosis
   c) First law of Thermodynamics
   d) Chemostat
   e) Log Phase
   f) Buffer
   g) Triglycerides
   h) Secondary Structure in Proteins
   i) Prosthetic Group
   j) Holo Enzyme
   k) Isomerases
   l) Enzyme Reversibility.

PART – B
UNIT - I
Answer any TWO complete questions from the following   2x10=20

II. a) Explain the mechanism of active transport and facilitated diffusion
        in microorganisms.   06
     b) Classify bacteria based on gaseous requirements.   04

III. a) Define bacterial growth. Add a note on synchronous growth.   06
     b) Write briefly on macronutrients.   04

IV. a) Explain the types of asexual reproduction in bacteria.   06
     b) Classify bacteria based on nutritional requirements.   04

UNIT-II
Answer any TWO complete questions from the following   2x10=20

V.   a) Define Carbohydrates. Explain the general characteristics of polysaccharides   06
     b) Write a note on properties of water.   04

VI. a) Explain the structure and importance of t RNA   .   06
     b) Write a note on denaturation of proteins   04

VII. a) Explain the principle and working of PAGE.   06
     b) Write a note on standard free energy.   04

UNIT-III

Answer any TWO complete questions from the following   2x10=20

VIII.	a)	Explain the mechanism of enzyme action.	06
	b)	Write a note on cofactors.	04
IX.	a)	Classify enzymes based on the type of reaction catalysed.	06
	b)	Write a note on oxidoreductases.	04
X.	a)	Explain any two types of enzyme specificity with examples.	06
	b)	Write briefly on pH and temperature inhibitors.	04

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CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019

MICROBIOLOGY
MICROBIAL GROWTH

Duration: 3 Hours   Max Marks: 80

Note: Draw diagrams wherever necessary.

PART A

I.   Answer any <u>TEN</u> of the following: 2x10=20
   a) Protein Denaturation
   b) Isomerases
   c) Starch
   d) Neutrophiles
   e) ES Complex
   f) Induction Method
   g) Steroids
   h) Exponential Phase
   i) Bioenergetics
   j) Diffusion
   k) Active Site
   l) Peptide Bond

PART-B
Answer any TWO complete questions from each unit

UNIT-I

II.   a) Explain the methods of Measurement of Microbial growth by using cell number. 06
      b) Write a note on Active Transport and Osmosis.   04

III. a) Explain the bacterial growth curve   .   06
      b) Write a note on asexual reproduction of bacteria.   04

IV.   a) Explain the classification of bacteria based on their Gaseous Requirements.   06
      b) Write a note on Micronutrients.   04

UNIT-II

V.   a) Explain the classification of proteins based on source and biological functions. 06
      b) Write a note on DNA.   04

VI.   a) Explain the laws of Thermodynamics. Add a note on standard free energy change.
                                                                                          06
      b) Write a note on Acids and Buffers.   04

VII. a) Discuss the Chemical properties of Monosaccharides.   06
      b) Write a note on Triglycerides.   04

UNIT-III

VIII. a) Discuss the Mechanism of Enzyme Reaction.   06
      b) Write a note on Heat Sensitivity.   04

IX.   a) Classify enzymes with suitable examples.   06
      b) Write a note on Fischer's Lock and Key Model.   04

X.   a) Explain the specificity of enzyme Action.   06
      b) Write a note on Coenzymes and Cofactors.   04

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MIC 501.1   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
MICROBIOLOGY
IMMUNOLOGY AND MEDICAL MICROBIOLOGY
Duration: 3 Hours   Max Marks: 80

Note: Draw diagrams wherever necessary.

PART A

I.   Answer any <u>TEN</u> of the following: 2x10=20

   a) Pseudomonas
   b) Polymixin
   c) Antibiotic Resistance
   d) T cells
   e) Signet Ring
   f) Antiviral Agents
   g) Precipitation Reaction
   h) Passive Immunity
   i) Vaccines
   j) Hepatitis
   k) Albendiazole
   l) Candidiasis

PART-B

Answer any TWO complete questions from each unit

UNIT-I

II. a)   Define Hypersensitivity. Write a note on the classification of Hypersensitivity
          Reactions   06
     b)   Write a note on I_gM and I_gE 04

III. a)   Explain the hybridoma technique for monoclonal antibody production.   06
     b)   Write a note on uses of Antigens.   04

IV. a)   Explain the mechanisms of Innate Immunity.   06
     b)   Write a note on agglutination Reactions.   04

UNIT-II

V. a) Explain the Morphology, Habitat, Pathogenesis, Lab diagnosis and treatment of *Aspergillus*.   06

   b) Write a note on on HIV.   06

                                                                             04

VI. a) Explain the Pathogenesis, Lab Diagnosis and treatment of *Escherichia*.   06

    b) Write a note on *Trichomonas*.   04

VII. a) Explain the Pathogenesis, Lab diagnosis and treatment of *Plasmodium Vivax*.06

     b) Write a note on Shigella.   04

UNIT-III

VIII. a) Explain the paper disc diffusion assay of Antibiotics.   06

      b) Write a note on factors affecting antimicrobial control.   04

IX. a) Explain the general mode of action of antimicrobial agents.   06

    b) Write a note on Tube Dilution Method.   04

X. a) Briefly explain the mode of action of Cephalosporins and Chloramphenicol.

                                                                            06

    b) Write a note on Antifungal Agents.   04

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MIC502.1   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION
OCTOBER 2019
MICROBIOLOGY
ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Duration: 3 Hours   Max Marks: 80

Note: Draw diagrams wherever necessary.

PART - A

I.   Answer any <u>TEN</u> of the following: 10X2=20
   a) Ground Water
   b) Slit Device
   c) VAM
   d) Coagulants
   e) Mumps
   f) *Pyricularia oryzae*
   g) Completed Test
   h) Droplet Nuclei
   i) Commensalism
   j) BOD
   k) BCG
   l) Carriers in Biofertilizer.

PART – B
UNIT – I

Answer any <u>TWO</u> complete questions from the following   2X10=20

II.   a) Explain filtration process of purification of drinking water by slow sand filter.   06
      b) Discuss the factors affecting the growth of microbes in stored water.   04

III. a) Explain the methods of small scale treatment of sewage.   06
      b) Write a note on membrane filtration method.   04

IV.   a) Explain the biological methods of sewage treatment.   06
      b) Write a note on microflora of water.   04

UNIT-II

Answer any <u>TWO</u> complete questions from the following   2X10=20

V.   a) Discuss the different types of fungal air borne diseases   06
      b) Write a note on Hollaender and Dalla Valle sampler.   04

VI.   a) Explain any two impingement methods of enumeration of air microflora.   06
      b) Write a note on vertical cylinder spore trap.   04

VII. a) Discuss any two bacterial air borne diseases.   06
      b) Write a note on indoor air microflora.   04

UNIT-III

Answer any <u>TWO</u> complete questions from the following   2X10=20

| VIII. | a) | Explain the role of secondary metabolites in disease development. | 06 |
| | b) | Write a note on microbial insecticides. | 04 |

| IX. | a) | Discuss the different types of antagonistic interactions in microorganisms. | 06 |
| | b) | Write a note on super bug. | 04 |

| X. | a) | Explain the different steps of lignin and pectin degradation. | 06 |
| | b) | Write a note on Cyanobacteria biofertilizer. | 04 |

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19ZOO101   Reg. No...............................

CHOICE BASED CREDIT SYSTEM FIRST SEMESTER B.Sc. DEGREE EXAMINATION
OCTOBER 2019
ZOOLOGY
Paper I: Zoomorphology-I

Duration: 3 Hrs.   Max. Marks: 80

Note: Answer any TEN questions from PART – A
Answer SIX questions from PART – B choosing any two questions from each unit.

PART – A

1. Answer any TEN of the following: 10×2=20

   a) Define hot spots. Name any two hotspots of India.

   b) List any two characters of class Mastigophora. Give two examples.

   c) Write a note on Scleroblasts.

   d) Write any two differences between Polyp and Medusa.

   e) Write any two distinctive characters of class Trematoda.

   f) Give the scientific name of Paddle worm and Hug worm.

   g) Distinguish between Male and female Ascaris.

   h) Draw a neat labeled diagram of Scolex of tape worm.

   i) What is thelycum? Where is it found?

   j) Mention the classes to which Unio and Pila belong.

   k) Name the different types of trophy in insects.

   l) Name any two larval forms and their respective classes of phylum Echinodermata.

PART – B
UNIT – I

II. a) With a neat labeled diagram, explain the life history of *Entamoeba histolytica*.   (07)

     b) Explain any three important principles of binomial nomenclature.   (03)

III. a) Describe the Ascon and Ascon types of canal systems in sponge.   (07)

     b) Write a note on Tetraxon spicules.   (03)

IV. a) Explain polymorphism with reference to Halistemma.   (05)

     b) Explain the life cycle of *Plasmodium vivax* in mosquito.   (05)

UNIT – II

V.   a) Explain ther externals of filarial worm. Add a note on its pathogencity.   (07)

     b) Draw a neat labeled diagram of earthworm.   (03)

VI. a) Enumerate the general characters of phylum Annelida. Classify it upto classes.   (07)

b) Explain the pathogenecity of Pinworms in humans..   (03)

VII. a) Explain any eight general characters of phylum Platyhelminthes with two examples.(05)

b) With a neat labeled diagram, explain the external features of leech.   (05)

UNIT – III

VIII. a) Describe the cephalic appendages of Penaeus.   (07)

b) Write short note on pedicellariae.   (03)

IX. a) Classify phylum Mollusca upto classes giving two distinctive characters and one representative example..   (07)

b) Mention three differences between Anopheles and Culex.   (03)

X. a) Explain the water vascular system in Asterias.   (05)

b) Explain the chemical method of Pest management.   (05)

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ZOO 101.2   Reg. No. ....

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
ZOOLOGY
ZOOMORPHOLOGY - I

Duration: 3 hours   Max Marks: 80

Note: Answer any TEN Questions from Part-A
      Answer SIX questions from Part-B choosing any two questions from each unit.

PART A

I.   Answer any <u>TEN</u> of the following: 10x2=20

1.   Define Binomial nomenclature. Expand ICZN.

2.   Name the four types of amoebocytes in Poriferans.

3.   Name any 2 locomotory organelles present in protozoans.

4.   Give an example each for fringing reef and barrier reef.

5.   What is pseudocoelom? Give an example.

6.   What are flame cells? Mention their function.

7.   Write any two differences between male and female Ascaries.

8.   Write any two characters of Class Polychaeta. Give 2 examples.

9.   Draw a neat labelled diagram of mandible of Penaecus.

10. What is radula? Mention its function.

11. Write any two distinguishing characters of Cephalopoda.

12. Name any four types of trophi in insects.

PART-B
UNIT-I

II. a) Give an account of life history of Plasmodium vivax in man with diagrams. 07

     b) Write the scientific names of following three animals
         (i) Liver fluke (ii) Filarial worm (iii) Tape worm   03

III. a) What is Polymorphism? Explain the phenomenon in Hydrozoa with
         reference to Halistemma.   07

     b) Draw a neat labelled diagram of trophozoite of Entamoeba histolytica. 03

IV   a) Give a schematic representation of classification of animals.   05

     b) Write any eight general characteristics of Phylum Porifera.
         Give two examples.   05

UNIT-II

V. a) Give an account of Parasites and host parasitic interactions with reference to helminthes.   07

  b) Write any six characters of Phylum Nemathelminthes.   03

VI. a) With a neat labelled diagram explain the external features of Pheretima.   07

  b) Write a note on Ascariasis.   03

VII. a) Write a note on hook worms and their Pathogenecity.   05

  b) Explain the ecological importance of annelids.   05

UNIT-III

VIII. a) Describe the water-vascular system of sea star.   07

  b) Draw a neat labelled diagram of Glochidium larva.   03

IX a) Give an account of general characters of Phylum Mollusca. Give two examples.   07

  c) Name any three classes of Phylum Arthropoda. Give an example for each class.   03

X. a) Mention the differences between Anopheles and Culex.   07

  b) Write any six distinguishing features of Class Ophiuroidea with two examples.   03

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18ZOO301

CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019

ZOOLOGY

Paper III: Physiology, Biochemistry & Immunology

Duration: 3 Hrs.   Max. Marks: 80

Note: Answer any **TEN** questions from **PART – A**

Answer **SIX** questions from **PART – B** choosing any two questions from each unit.

PART – A

1. Answer any TEN of the following: 10×2=20

   a) What is general physiology?

   b) What are chloride secreting cells?

   c) Name the chief nitrogenous excretory substances in animals.

   d) What are respiratory pigments?

   e) What is pacemaker?

   f) What is emulsification?

   g) Draw a neat labeled diagram of smooth muscle fibre.

   h) Name any 2 types of synapses.

   i) Mention any four biological significance of carbohydrates.

   j) Define competitive inhibitors. Give two examples.

   k) Write any two important functions of Vitamin C.

   l) What is Malt?

PART – B

UNIT – I

II. a) Explain the physiology of transport of CO_2 by blood.   (07)

     b) Explain the scope of physiology.   (03)

III. a) Explain counter multiplier system in humans.   (07)

     b) Write any three adaptations of camel for osmoregulation.   (03)

IV. a) Define osmoregulation. Differentiate osmoregulation in marine and fresh water teleosts (05)

     b) Write the schematic representation of ornithine cyle.   (05)

UNIT – II

V.   a) Explain the composition of human blood.   (07)

     b) Write a note on sodium potassium pump.   (03)

VI. a) With a neat labeled diagram explain the structure of human ear.   (07)

     b) Describe the ultrastucture of striated muscle fiber.   (03)

VII. a) Explain protein digestion in man.   (05)

    b) Write a note on neuromuscular function.   (05)

UNIT – III

VIII. a) Describe the mechanism of enzyme catalyzed reaction.   (07)

     b) Draw a neat labeled diagram of IgG   (03)

IX. a) Give an account of primary lymphoid organs.   (07)

    b) What is straight chain structure? Give an example.   (03)

X.   a) Describe the source, chemical nature and deficiency disorder of Vitamin D and K. (05)

    b) Explain the secondary structure of proteins with illustrations.   (05)

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ZOO 301.2   Reg. No...............................

CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
ZOOLOGY
Paper III: Physiology, Biochemistry & Immunology

Duration: 3 Hrs.   Max. Marks: 80

Note: Answer any TEN questions from PART – A
Answer SIX questions from PART – B choosing any two questions from each unit.

PART – A

1. Answer any TEN of the following:-   10×2=20

    1) What is Endocrinology?

    2) Name the chief nitrogenous excretory substances in animals.

    3) What are chloride secreting cells?

    4) What is Bohr Effect?

    5) What are perkinje fibres?

    6) Name any two enzymes present in pancreatic juice.

    7) Draw a neat labeled diagram of smooth muscle fibre.

    8) Define resting potential in neuron.

    9) What are co-enzymes? Give two examples.

    10) What are monosaccharides?

    11) What is scurvy?

    12) Mention the functions of macrophages.

PART – B
UNIT – I

II.   a) Give an account of thermoregulation.   (07)

      b) Draw a neat labelled diagram of a nephron.   (03)

III. a) Explain the physiology of transport of carbon dioxide by blood.   (07)

      b) Explain the scope of physiology.   (03)

IV.   a) With respect to humans explain ornithine cycle.   (05)

      b) Explain the desert adaption in kangaroo rat.   (05)

UNIT – II

V.   a) With a neat labelled diagram, describe the internal structure of human heart. (07)

      b) Write a note on fat absorption.   (03)

VI.   a) Explain the ultrastructure of striated muscle fibre.   (07)

      b) Explain the structure of synapse.   (03)

VII. a) Explain carbohydrate digestion in man. (05)

b) Draw a neat labelled diagram of human eye. (05)

UNIT – III

VIII. a) Classify the proteins based on the chemical composition. (07)

b) What are antigen and antigenecity? (03)

IX. a) Describe the mechanism of enzyme catalyzed reaction. (07)

b) Write note on Glycolipids. (03)

X. a) What are the biological functions and deficiency disorders of vitamin C. (05)

b) Give an account of primary lymphoid organs in humans. (05)

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ZOO 501.2   Reg. No................................

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
ZOOLOGY
Paper V: Cell Biology, Molecular Biology and Genetic Engineering
Duration: 3 Hrs.   Max. Marks: 80

Note: Answer any TEN questions from PART – A
Answer SIX questions from PART – B choosing any two questions from each unit.

PART – A

1. Answer any TEN of the following: 10×2=20

   a) Write any two functions of Golgi Complex.

   b) What are cell junctions? Mention the types.

   c) Write any two functions of intermediate filaments.

   d) Name the different phases of a cell cycle.

   e) Write any two significance of Meiosis.

   f) What is a mitotic poison? Give two examples.

   g) What is metastasis?

   h) Define the process of transduction.

   i) What is splicing?

   j) Write any two applications of DNA fingerprinting.

   k) Define genetic code. Name any one terminator codon.

   l) Name any four branches of Cell biology.

PART – B
UNIT – I

II. a) Give an account of morphology of eukaryotic chromosome with reference to number, size and types of chromosomes.   (07)

     b) Write a note on Sodium Potassium Pump.   (03)

III. a) What are Giant chromosomes? Give an account of structure and function of lampbrush chromosomes.   (07)

     b) Write any three differences between euchromation and heterochromation.   (03)

IV. a) What is a karyotype? How is it prepared   (05)

     b) Describe the structural organization of microtubules.   (05)

UNIT – II

V.   a) With the help of labeled diagrams, explain prophase-I of meiosis.   (07)

     b) Explain the role of cytoplasm in differentiation with the example of HeLa cells.   (03)

VI.	a)	Enumerate the characteristics of cancer cells with an illustration.	(07)
	b)	Write a brief note on antioxidents.	(03)
VII.	a)	Describe the Metaphase stage of mitosis.	(05)
	b)	Explain the main types of cancer with examples.	(05)

UNIT – III

VIII.	a)	Describe the process of replication. Add a note on the enzymes involved.	(07)
	b)	List the steps involved in gene cloning.	(03)
IX.	a)	Describe the isolation of DNA by shotgun method.	(07)
	b)	Write short note on any three forms of DNA.	(03)
X.	a)	Explain the process of translation during protein synthesis.	(05)
	b)	Write a note on plasmids as a vector.	(05)

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ZOO 502.2   Reg. No....................................

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
ZOOLOGY
Paper VI: Developmental Biology
Duration: 3 Hrs.   Max. Marks: 80

Note: Answer any **TEN** questions from **PART – A**
Answer **SIX** questions from **PART – B** choosing any two questions from each unit.

PART – A
1. Answer any TEN of the following: 10×2=20

   a) Name any two accessory sex organs in human male.

   b) Write any two scope of embryology.

   c) Mention the steps in menstrual cycle.

   d) Write a note on invitrofertilization.

   e) Define polyspermy. Where do you find it.

   f) What is holoblastic cleavage? Give an example.

   g) Why dorsal lip of blastopore is called organizer?

   h) What is fatemap? Give its significance.

   i) List two functions of Chorion.

   j) What are germ layers? Name them.

   k) Give any four significance of Placenta.

   l) What are identical twins?

PART – B
UNIT – I

II. a) What are secondary sexual characters?   (07)

     b) Enumerate the significance of parthenogenesis.   (03)

III. a) Explain the phase of growth in oogensis with the help of suitable diagrams..   (07)

     b) What is surrogate mother.   (03)

IV. a) Explain Arrhenotoky giving suitable examples.   (05)

     b) Explain sperm bank   (05)

UNIT – II
V. a) With labeled diagram explain Acrosomal reaction and sperm penetration..   (07)

     b) State Hertwigs Law of Cleavage.   (03)

VI. a) "With labeled diagrams, explain the process of gastrulation in frog.   (07)

     b) Explain the chemical nature of organizer.   (03)

VII. a) Explain transplantation experiments of Spemann and mangold on amphibian gastrula. (05)

b) Write a note on spiral cleavage. (05)

UNIT – III

VIII. a) Describe and classify the placenta on the bases of morphological structure. (07)

b) Write explanatory note on yolk sac. (03)

IX. a) Draw a labeled diagram of a human graafian follicle and explain. (07)

b) Give the functions of Ammion. (03)

X. a) Discuss the role of hormones produced by the placenta. (05)

b) Draw a neat labeled diagram of 18hrs chick embryo and explain. (05)

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19STA101   Reg. No. ....

CHOICE BASED CREDIT SYSTEM FIRST SEMESTER B.Sc. DEGREE
EXAMINATION OCTOBER - 2019
STATISTICS
PAPER I – DESCRIPTIVE STATISTICS & PROBABILITY THEORY

Time: 3 Hrs   Max. Marks: 80

PART - A

Answer any TEN of the following: 10X2=20

1. a) Distinguish between nominal scale and ordinal scale.

   b) Define continuous variable with an example.

   c) Show that if one of the regression coefficient is greater than unity then the other must be less than unity.

   d) What do you understand by intraclass correlation coefficient?

   e) Define independence of two events. Give an example.

   f) Define probability distribution function and mention its properties.

   g) Explain how mean and variance can be obtained from moment generating function.

   h) In a bivariate distribution, define marginal and conditional probability mass function.

   i) Why is Fisher's index number called ideal.

   j) Write down any two uses of Consumer Price Index number.

   k) State Pareto's law of income distribution.

   l) How do you construct chain base index number?

PART – B

Answer any TWO of the following: 2X10=20

2. a) Write a short note on primary data, secondary data and cross sectional data.   (5)
   b) The variables X and Y are related by the equation ax+by+c=0. Show that the correlation coefficient between them is -1 if the sign of a and b are alike and 1 if they are different.
                                                                                             (5)

3. a) Show that regression coefficient is independent of change of origin but not of scale.   (3)

   b) Obtain the expression for the angle between two regression lines and interpret the value r =0 and r=1   (7)

4. a) Drive an expression for $R_{1.23}$ (5)
   b) With usual notations prove that
      $$\sigma_{1.23}^2 = \sigma_1^2 (1 - r_{12}^2)(1 - r_{13.2}^2)$$ (5)

Answer any TWO of the following: 2X10=20

5. a) State and prove Baye's Theorem of Inverse Probability.   (5)
   b) In a company there are three machine operators X,Y and Z respectively. Amount of work done by these three operators are 20% 30% and 25% respectively. The chances of

producing defective items from X,Y and Z are 0.1, 0.2 and 0.35 respectively. Suppose produced product turns out to be defective then what is the probability that it is produced by an operator Y? (5)

6. a) A random varaiable X has the probability density function, $f(x) = 6x(1-x), 0 \le x \le 1$. Find the mean and standard deviation of X. (6)
   b) If A and B are two independent events, show that A^1 and B^1 are independent. (4)

7. a) Show that conditional probability P(B/A) satisfies the axioms of probability. (5)
   b) State and prove addition theorem of expectation. (5)

Answer any TWO of the following: 2X10=20

8. a) Describe time reversal test and factor reveral test. Also verify whether Marshall Edgworth's index number satisfies theses tests. (7)
   b) Explain index number and mention its uses. (3)

9. a) Write a short note on Lorenz curve and Gini's coefficient. (5)
   b) Mention the applications of Pareto and Lognormal income distributions. (5)

10. a) Describe price elasticity and demand. (5)
    b) Explain Engel's law and critically comment on it. (5)

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CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019.
STATISTICS
ESTIMATION THEORY AND TIME SERIES ANALYSIS

Time: 3 Hrs   Max. Marks: 80

PART - A

Answer any TEN of the following: 10x2=20

1. a) Show that if T_n is unbiased for θ and if $g(\theta)$ is a linear function of θ then $g(T_n)$ is unbiased for $g(\theta)$.

   b) State Fisher Neymann criteria for sufficiency.

   c) Define consistency.

   d) Mention any two properties of moment estimators.

   e) What is meant by interval estimation?

   f) Define the following:

      i) Cyclical variation   ii) Exponential Smoothing.

   g) State whether each of the following statement is true or false.

      i) Reduction in production due to fire in a factory is a seasonal component of time series.
      ii) Moving average can give estimate of trend for future.

   h) Define autocorrelation function & mention its two properties.

   i) Explain correlogram.

   j) What do you understand by queuing model?

   k) Define birth and death process.

   l) What is traffic intensity?

PART – B

Answer any TWO of the following: 2x10=20

2. a) If $X_1, X_2 \ldots\ldots X_n$ be a random sample from $U(-\theta, \theta)$ distribution. Show that $X_{(n)}$ is biased for θ. Find a function of $X_{(n)}$ which is unbiased for θ. Is $X_{(n)}$ asymptotically unbiased?

   b) If $X_1, X_2 \ldots\ldots\ldots X_n$ is a random sample from $N(\mu, \sigma^2)$. Show that the sample mean and sample variance are jointly sufficient for μ and σ^2.   (5+5)

3. a) Obtain the m.l.e of the parameter β in the following distribution.

   $$f(X; \alpha, \beta) = \frac{\beta^\alpha}{\Gamma \alpha} e^{-\beta x} x^{\alpha-1}; \quad x \geq 0, \alpha > 0, \beta > 0$$

   Where α is known.

   b) If $X_1, X_2 \ldots\ldots X_n$ be a random sample from $B(n, \theta)$. Obtain moment estimators of the parameters.   (5+5)

4. a) Derive $100(1-\alpha)\%$ central confidence interval for difference in means of two independent normal populations with unknown mean but common variance.

b) Derive $100(1-\alpha)\%$ central confidence interval for difference in proportions of two independent populations based on 2 samples of large sizes. $(6+4)$

Answer any TWO of the following: $2 \times 10 = 20$

5. a) Explain the components of time series analysis with example.

b) How do you identify the types of time series data using correlogram. $(6+4)$

6. a) Describe ratio to moving average method of removing seasonal component from a time series.

b) Derive normal equations for fitting an exponential trend of the form $y = ae^{bt}$ (

$(5+5)$

7. a) Describe different types of stationary time series.

b) Explain forecasting through exponential smoothing. $(5+5)$

Answer any TWO of the following: $2 \times 10 = 20$

8. a) Briefly explain the characteristics of queuing system.

b) State and prove Markovian property of inter arrival time. $(5+5)$

9. Employing the birth – death methodology obtain the steady state distribution of the number of customers in the M/M/1 queuing system. (10) (

10. a) For the M/M/1/ FIFO queuing system derive an expression for waiting time in queue under state.

b) State and prove arrival distribution theorem in queuing models. $(3+7)$

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STA 501   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
STATISTICS
PAPER V - SAMPLING THEORY

Time: 3 Hrs   Max. Marks: 80
                              PART - A
Answer any TEN of the following: 2X10=20

1. a) Define a sampling.

   b) What is the need for sampling?

   c) What do you understand by Random sampling?

   d) What are finite and infinite populations?

   e) Distinguish between an Estimator and Estimate.

   f) How should stratification be done to obtain maximum increase in the precision?

   g) Mention any two advantages of systematic sampling.

   h) Give an example for cluster sampling.

   i) Differentiate between SRSWR and SRSWOR.

   j) What is judgment sampling?

   k) Explain proportional allocation in case of stratification.

   l) What is meant by PPS sampling?

                              PART – B
Answer any TWO of the following: 10x2=20

2. a) What are the main steps involved in a sample survey. Discuss them briefly.

   b) Explain non-sampling error with examples.   (6+4)

3. a) Explain the method of selecting a random sample from a frequency distribution.

   b) State the advantages of sampling over complete census.   (4+6)

4. a) What do you mean by a Pilot survey? Explain with an example.

   b) Explain the principles of sample survey.   (6+4)

Answer any TWO of the following: 10x2=20

5. a) Prove that under SRSWOR sample mean square is an unbiased estimator of the population mean square.

   b) Under SRSWOR, obtain an expression for the determination of sample size. (5+5)

6. Derive an unbiased estimator of the population mean and its variance under SRSWR. Also show that $V\left(\bar{Y}\right)_{SRSWOR} \leq V\left(\bar{Y}\right)_{SRSWR}$ (10)

7. With usual notations prove that
$$V\left(\bar{y}_{st}\right)_{opt} \leq V\left(\bar{y}_{st}\right)_{prop} \leq V\left(\bar{y}\right)_{SRSWOR}$$ (10)

Answer any TWO of the following: 10x2=20

8. a) Explain systematic sampling. Show that systematic sample mean is an unbiased estimator of population mean.

   b) With usual notations, prove that systematic sampling is more efficient that simple random sampling if $S^2_{wsy} > S^2$ (5+5)

9. a) Compare systematic sampling with SRSWOR in terms of intraclass correlation efficient.

   b) Derive an expression for $V\left(\bar{Y}_{sys}\right)$ in terms of intraclass correlation. (5+5)

10. a) Briefly explain Quota sampling and Multistage sampling.

    b) If the population consists of a linear trend, then prove that
$$V\left(\bar{Y}_{st}\right) \leq V\left(\bar{Y}_{sys}\right) \leq V\left(\bar{Y}_{SRSWOR}\right)$$ (4+6)

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STA 502.1   Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2019
STATISTICS
OPERATIONS RESEARCH - I

Time: 3 Hrs   Max. Marks: 80
PART - A
Answer any TEN of the following: 2X10=20

1. a) Define an LPP..

   b) Point out the criteria for existence of
      (i) Tie for the entering variable
      (ii) Tie for the leaving variable in the simplex method.

   c) Mention any two properties of LPP.

   d) What is Simplex method?

   e) What do you mean by dual of an LPP?

   f) Mention any two applications of duality in LPP.

   g) Given a non-degenerate basic feasible solution, how do you verify the optimality condition in T.P.?

   h) Write down the mathematical model of transportation problem.

   i) When do you say that an assignment problem is unbalanced?

   j) Mention the situation which makes the replacement of items necessary.

   k) Define optimum replacement age.

   l) Define 'loop' in a transportation problem.

PART – B

Answer any TWO of the following: 10x2=20

2. a) What is OR ? Explain the nature of OR.

   b) Describe Iconic model and Symbolic model with examples.   (5+5)

3. a) Explain the graphic method of solving a LPP with two decision variables.

   b) With reference to an LPP, define
      (i) feasible solution (ii) optimum solution (iii) unbounded solution

                                                                    (4+6)
4. a) Describe the two-phase method of solving a LPP.

   b) Write short notes on degeneracy in the Simplex method.   (4+6)

Answer any TWO of the following. 10x2=20

5. a) Mention the properties of a dual LPP.

   b) Construct the dual of the following problem.

   Max. $Z = 3x_1 + 10x_2 - 2x_3$

   subject to $\quad 2x_1 + 3x_3 + 2x_3 \leq 7$

   $\quad\quad\quad\quad 3x_1 - 2x_2 + 4x_3 = 3$

   $\quad\quad\quad\quad x_1, x_2, x_3, \geq 0$ $\hspace{3cm}$ (5+5)

6. a) Mention the various steps involved in the dual simplex algorithm.

   b) Show that if the pth variable of the primal is unrestricted in sign, the pth constraint of the dual is an equation. $\hspace{2cm}$ (6+4)

7. a) Explain the role of duality for sensitivity analysis of LPP.

   b) Explain the effect of the following on optimality or feasibility of current optimal solution.
      (i) change in requirement vector b
      (ii) change in cost vector c $\hspace{3cm}$ (4+6)

Answer any TWO of the following. 10x2=20

8. a) Explain an Assignment problem and give its mathematical formulation.

   b) Describe the Hungarian method of solving an assignment problem. $\hspace{1cm}$ (4+6)

9. a) Explain the Vogel's approximation of finding an initial feasible solution of a Transportation problem.

   b) Describe the MODI method of solving a Transportation method. $\hspace{1.5cm}$ (5+5)

10. a) Explain how the theory of replacement is used in the problem of replacement of items that fail completely.

    b) Explain money value, present value and discount rates. $\hspace{2cm}$ (6+4)

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