Total No. of Printed Pages—4

**6 SEM TDC DSE MTH (CBCS) 6 (H)**

**2022**

( June/July )

MATHEMATICS

( Discipline Specific Elective )

( For Honours )

Paper : DSE–6

**( Mathematical Methods )**

*Full Marks* : 80
*Pass Marks* : 32

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** *(a)* Write the period of $\sin 2x$. 1

*(b)* Write two sufficient conditions for a function to be expanded in a Fourier series. 2

*(c)* Find the Fourier series for the function $f(x) = \pi + x$ in the interval $(0, 2\pi)$. 7

*Or*

Find the Fourier series for the function $f(x) = x$ in the interval $(0, \pi)$.

**2.** *(a)* Write the value of $L\{t^2\}$. 1

*(b)* Write the value of $L\{e^{4t}\}$. 1

*(c)* Find $L\{\sin 2t\}$. 2

*(d)* Find any *four* of the following : 4×4=16

*(i)* $L\{\cosh^2 2t\}$

*(ii)* $L\{e^{3t}\cos 2t\}$

*(iii)* $L\{(t^2+1)^2\}$

*(iv)* $L\{(1+te^t)^3\}$

*(v)* $L\{\sin^3 2t\}$

*(vi)* $L\{t\sin^2 2t\}$

**3.** *(a)* Write the value of $L^{-1}\{2\}$. 1

*(b)* Write the value of $L^{-1}\left\{\frac{S}{S^2+9}\right\}$. 1

*(c)* Find any *two* of the following : 4×2=8

*(i)* $L^{-1}\left\{\frac{1}{(S+1)(S+2)}\right\}$

*(ii)* $L^{-1}\left\{\frac{S^2}{(S+2)^3}\right\}$





*(iii)* $L^{-1}\left\{\frac{S}{(S+1)^{\frac{3}{2}}}\right\}$

*(iv)* $L^{-1}\left\{\log\frac{S+6}{S+2}\right\}$

**4.** *(a)* Write the Fourier sine integral formula. 1

*(b)* Write the Dirichlet's conditions of Fourier transform. 2

*(c)* Answer any *three* of the following : 5×3=15

*(i)* State and prove the change of scale property of Fourier transform.

*(ii)* Find the Fourier transform of

$$f(x) = e^{-\frac{x^2}{2}},\ -\infty < x < \infty$$

*(iii)* Find the inverse Fourier transform of $e^{-|s|y}$.

*(iv)* Show that

$$F\{x^n f(x)\} = (-i)^n \frac{d^n}{ds^n}(\bar{f}(s))$$

*(d)* Find the Fourier sine and cosine transforms of $f(x) = x$. 7

*Or*

Find the Fourier transform of

$$f(x) = \begin{cases} \cos x, & \text{for } |x| < a \\ 0, & \text{for } |x| > a > 0 \end{cases}$$

**5.** *(a)* Write the value of $L\left\{\frac{\partial y}{\partial t}\right\}$. 1

*(b)* Find $L\left\{\frac{\partial y}{\partial x}\right\}$. 2

*(c)* Solve any *two* of the following, using Laplace transform : 6×2=12

*(i)* $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 5y = 5,\ y(0) = y'(0) = 0$

*(ii)* $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t,$

$y(0) = y'(0) = 0$

*(iii)* $\frac{d^2y}{dt^2} + y = 0,\ y(0) = 1,\ y'(0) = 0$

*(iv)* $\frac{dx}{dt} + y = \sin t,\ \frac{dy}{dt} + x = \cos t$

$x(0) = 2,\ y(0) = 2$

★★★

Total No. of Printed Pages—3

# 6 SEM TDC DSE ZOO (CBCS) 4 (H)

## 2022

( June/July )

ZOOLOGY

( Discipline Specific Elective )

( For Honours )

Paper : DSE–4

**( Parasitology )**

*Full Marks* : 53
*Pass Marks* : 21

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** Fill in the blanks : 1×5=5

*(a)* The parasite that lives inside the host body is known as ____.

*(b)* ____ causes amoebic dysentery.

*(c)* ____ is the definitive host for *Taenia solium*.

(d) _____ is a root-knot nematode.

(e) The scientific name of head louse is _____.

**2.** Explain any *two* of the following : 4×2=8

(a) Cookiecutter shark

(b) Control of ticks

(c) Vectors

**3.** Write explanatory notes on any *two* of the following : 4×2=8

(a) Pathogenicity and treatment of *Leishmania donovani*

(b) Life cycle of *Fasciolopsis buski*

(c) Relationship between host and parasite

(d) Biology and importance of *Xenopsylla cheopis*

**4.** Describe about the morphology, life cycle and pathogenicity of *Plasmodium vivax*. 2+3+3=8

*Or*

Describe about the morphology, life cycle and pathogenicity of *Giardia intestinalis*. 2+3+3=8





**5.** Give an explanatory description on the prevalence, epidemiology, diagnosis and treatment of *Schistosoma haematobium*. 2+2+2+2=8

*Or*

Give an explanatory description on the prevalence, epidemiology, diagnosis and treatment of *Taenia solium*. 2+2+2+2=8

**6.** Describe about the morphology, prophylaxis and treatment of *Ascaris lumbricoides*. 2+3+3=8

*Or*

Describe about the morphology, prophylaxis and treatment of *Wuchereria bancrofti*. 2+3+3=8

**7.** Describe about the biology, importance and control of body louse. 2+3+3=8

*Or*

Describe about the mode of infection and manner of control on several parasitic vertebrates. 8

★ ★ ★

**6 SEM TDC DSE PHY (CBCS) 1 (H)**

**2022**

( June/July )

PHYSICS

( Discipline Specific Elective )

( For Honours )

Paper : DSE–1

**( Nuclear and Particle Physics )**

*Full Marks* : 80
*Pass Marks* : 32

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** Choose the correct answer : 1×5=5

*(a)* Which of the following elements possessing the highest value of binding energy per nucleon?

*(i)* Gold

*(ii)* Uranium

*(iii)* Iron

*(iv)* Mercury

(b) Nuclei having which of the following numbers of protons and neutrons are remarkably stable?

(i) 2, 8, 16, 28

(ii) 2, 8, 20, 28

(iii) 2, 8, 16, 20

(iv) None of the above

(c) Which of the following statements is correct?

(i) Beta rays are electromagnetic radiation.

(ii) Alpha rays are positively charged particles but beta and gamma rays are electromagnetic radiation.

(iii) Alpha rays are positively charged particles but beta rays are negatively charged particles and gamma rays are electromagnetic radiation.

(iv) None of the above

(d) The lepton number for a neutron is

(i) 1

(ii) –1

(iii) 0

(iv) None of the above

( Continued )





(e) The parity is violated in

(i) all elementary interactions

(ii) strong interactions

(iii) weak interactions

(iv) None of the above

**2.** (a) What is parity of a nucleus? 1

(b) Calculate the mass defect, binding energy and binding energy per nucleon for a lithium nucleus ($_3Li^7$), if

mass of the nucleus = 7·0 a.m.u.
mass of proton = 1·007825 a.m.u.
mass of neutron = 1·008665 a.m.u.
1 a.m.u. = 931·5 MeV 3

*Or*

Explain the term 'nuclear magnetic dipole moment'.

(c) Discuss the conclusions drawn from the graph between the binding energy per nucleon and mass number. How can release of energy in fission and fusion be explained from this graph? 3+2=5

**3.** (a) Discuss briefly the nature of nuclear force. 3

(b) Write down the semiempirical mass formula, describing the significance of each term. 4

(c) Discuss the evidences behind the shell structure of the nucleus. Give a qualitative description of the shell model of the nucleus. 3+3=6

**4.** (a) Find the half-life of $_{92}U^{238}$, if one gram of it emits $1{\cdot}24\times10^{4}$ alpha-particles per second. (Avogadro's number = $6{\cdot}025\times10^{23}$) 3

*Or*

Deduce the law of radioactive disintegration. What is 'half-life' of a radioactive material? 2+1=3

(b) Describe briefly the Geiger-Nuttal law for alpha particles. 2

(c) What is neutrino? Describe how the neutrino hypothesis could explain the continuous energy spectrum of beta decay. 1+3=4

**5.** (a) Describe the conservation laws followed by nuclear reactions. 3

(b) Discuss the compound nucleus theory of nuclear reaction. 3





(c) Calculate the energy released in the reaction

$$_{3}Li^{6} + {}_{0}n^{1} \rightarrow {}_{2}He^{4} + {}_{1}H^{3} + Q$$

if $m(_{3}Li^{6}) = 6{\cdot}015126\,u$;

$m(_{0}n^{1}) = 1{\cdot}0086654\,u$;

$m(_{2}He^{4}) = 4{\cdot}0026044\,u$;

$m(_{1}H^{3}) = 3{\cdot}016049\,u$. 3

*Or*

Derive a relation for nuclear reaction cross section.

**6.** Write short notes on any *two* of the following : 4×2=8

(a) Synchrotron radiation

(b) Bethe-Bloch formula

(c) Interaction of gamma ray with matter

**7.** Describe the principle and working of a Geiger-Müller counter. What is recovery time? What is 'quenching' and how can it be achieved? 4+2+1+2=9

*Or*

What are semiconductor particle detectors? What is its advantage over gas-filled detectors? Describe the theory and working of any one type of semiconductor particle detector. 1+2+3+3=9

**8.** Describe the principle and working of a linear accelerator. What are the disadvantages in using this accelerator? 4+1=5

*Or*

What are cyclic accelerators? What are the advantages of using a cyclic accelerator? Describe briefly the working of any one type of cyclic accelerator. 1+1+3=5

**9.** *(a)* What are fundamental interactions in nature? Give a comparison between the fundamental interactions. 1+3=4

*(b)* What are isospin of an elementary particle? Describe briefly the Gell-Mann-Nishijima scheme for elementary particles. 1+2=3

*(c)* What do you mean by strange particles? What is strangeness quantum number? 2+1=3



*( Continued )*



*(d)* Describe the classification of elementary particles on the basis of the standard model. 3

*Or*

What are quarks? Give the quark structure of protons and neutrons.

★★★

**6 SEM TDC DSE BOT (CBCS) 1 (H)**

**2022**

( June/July )

BOTANY

( Discipline Specific Elective )

( For Honours )

Paper : DSE–1

**( Plant Breeding )**

*Full Marks* : 53
*Pass Marks* : 21

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** *(a)* Choose the correct answer of the following : 1×3=3

*(i)* The offspring from a cross between two individuals differing in at least one set of characters is called

(1) polyploids

(2) hybrid

(3) mutant

(4) variant

(ii) Hand emasculation is generally recommended in crops with

(1) very small flower

(2) large flower

(3) monecious condition

(4) dioecious condition

(iii) A cross between a heterozygous individual with a homozygous recessive parent is known as

(1) monohybrid cross

(2) dihybrid cross

(3) test cross

(4) backcross

(b) Fill in the blanks : 1×2=2

(i) The cross of a hybrid of either of the parent-type is known as _____.

(ii) The process of bringing wild species under human management is referred to as _____.

**2.** Write short notes on the following : 3×4=12

(a) Genetic erosion

(b) Centres of origin

(c) Germplasm

(d) Polyploidy





**3.** Write explanatory notes on any *two* of the following : 6×2=12

(a) Role of biotechnology in crop improvement

(b) Important achievement of plant breeding in India

(c) Acclimatization

(d) Domestication

**4.** Define 'hybridization' and state its objectives. Discuss briefly the different steps of hybridization procedure and mention its limitations. 1+2+7+2=12

*Or*

Define inbreeding depression and hybrid vigour. How does this phenomenon affect the self- and cross-pollinated species? Explain with the help of suitable example. 3+2+7=12

**5.** What is quantitative inheritance? Give a detailed account of quantitative inheritance with special reference to Kernel colour in wheat. 2+10=12

*Or*

Write notes on the following : 4×3=12

*(a)* Mutation breeding

*(b)* Distant hybridization

*(c)* Importance of transgenic plants in crop improvement

★★★

**6 SEM TDC DSE CHM (CBCS) 2 (H)**

**2022**

( June/July )

CHEMISTRY

( Discipline Specific Elective )

( For Honours )

Paper : DSE–6.2

**( Industrial Chemicals and Environment )**

*Full Marks* : 53

*Pass Marks* : 21

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** Choose the correct answer from the following : 1×6=6

*(a)* The cause of minamata disease is

*(i)* Hg

*(ii)* Pb

*(iii)* Sn

*(iv)* Fe

(b) The most important agent for ozone layer depletion is

(i) methane

(ii) CFC

(iii) nuclear fallout

(iv) nitrous oxide

(c) Recommended TDS for drinking water is

(i) 600 mg/l

(ii) less than 500 mg/l

(iii) 650 mg/l

(iv) above 650 mg/l

(d) The chemical which protects stomach from hazardous action of HCl is

(i) secretin

(ii) mucous

(iii) bile

(iv) cortisol

(e) Blue energy is

(i) marine power

(ii) wind energy

(iii) solar energy

(iv) geothermal energy





(f) Biotic component of an ecosystem includes

(i) oxygen

(ii) protein

(iii) green plant

(iv) sunlight

**2.** Answer any *six* questions from the following : 2×6=12

(a) What is borax? Write any two uses of borax.

(b) Briefly describe reverse osmosis method for water treatment.

(c) Discuss about the bio-desulfurization of coal.

(d) What do you mean by a 'food web'?

(e) Write a note on the effluent from dairy industry.

(f) What are the advantages and disadvantages of solar energy?

(g) Describe any two effects of air pollution.

UNIT—I

**3.** Answer any *two* questions from the following : 3½×2=7

*(a)* How is potassium dichromate manufactured? Write the uses of it. What is the health effect of it? 1½+1½+½=3½

*(b)* Describe the steps involved in the manufacture of caustic soda by Castner-Kellner process. Write any one precaution which must be taken during the transportation of caustic soda. 3+½=3½

*(c)* Explain how sulphuric acid is prepared by contact process. What is oleum? 3+½=3½

UNIT—II

**4.** Answer any *one* question from the following : 4

*(a)* Write the different steps involved in the extraction of a metal from an ore. 4

*(b)* *(i)* What is a flux? Write the role of a flux in metallurgy. 2

*(ii)* Write a note on Van Arkel method. 2





UNIT—III

**5.** Answer any *four* questions from the following : 4×4=16

*(a)* What is an ecosystem? What are the different components observed in a pond ecosystem? 1+3=4

*(b)* Explain the different causes of arsenic pollution in drinking water.

*(c)* What are greenhouse gases and greenhouse effect? Discuss the contribution of these gases to global warming.

*(d)* Discuss about the causes and effects of ozone depletion. 2+2=4

*(e)* Describe any four methods of industrial waste management.

UNIT—IV

**6.** Answer any *one* question from the following : 4

*(a)* What are renewable and non-renewable energy sources? Write briefly about the advantages of renewable energy sources over conventional energy sources.

*(b)* What is biomass? Explain why biomass is an attractive source of energy.

UNIT—V

**7.** Answer any *one* question from the following : 4

*(a)* "Biocatalysis has many attractive features in the context of green chemistry and sustainable development." Explain it, giving four examples.

*(b)* What is biocatalysis? Discuss the advantages and disadvantages of bio-catalysts.

★★★

Total No. of Printed Pages—5

**6 SEM TDC DSE PHY (CBCS) 2 (H)**

**2022**

( June/July )

PHYSICS

( Discipline Specific Elective )

( For Honours )

Paper : DSE–2

**( Nanomaterials and Applications )**

*Full Marks* : 53
*Pass Marks* : 21

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** Choose the correct option from the following : 1×5=5

*(a)* A material with one dimension in nano range and the other two dimensions are large, is called

*(i)* micro material

*(ii)* quantum wire

*(iii)* quantum well

*(iv)* quantum dot

(b) What is the procedure in top-down fabrication method?

(i) Nanoparticles → Powder → Bulk

(ii) Powder → Bulk → Nanoparticles

(iii) Bulk → Powder → Nanoparticles

(iv) Nanoparticles → Bulk → Powder

(c) The empirical formula for obtaining crystallite size from XRD studies is given by

(i) $D = 2n\lambda \sin\theta$

(ii) $D = 2n\lambda \cos\theta$

(iii) $D = \frac{0{\cdot}99\lambda}{\beta \cos\theta}$

(iv) $D = \frac{n\lambda}{2 \sin\theta}$

(d) Excitons are

(i) negatively charged

(ii) positively charged

(iii) neutral

(iv) None of the above

(e) The main application of GMR is in

(i) hard disk

(ii) biosensors

(iii) MEMS

(iv) All of the above





**2.** (a) What is a quantum dot? 1

(b) What is meant by quantum confinement? What happens to the band gap of a material in the nano-regime? 1+1=2

(c) Write the expressions for wave function and energy due to quantum confinement within one-dimensional potential well. Draw the schematic diagram of wave functions and energies of the first three confined states of an infinite-depth potential well. 1+1+3=5

*Or*

Define density of states of materials at nano-regime. How does the three-dimensional (3-D) density of states differ from the two-dimensional (2-D) and one-dimensional (1-D) density of states? Explain with the help of schematics and plots. 1+4=5

**3.** (a) What do you mean by top-down and bottom-up approaches of nanostructured material synthesis? Give examples of each case. 2+1=3

(b) Write briefly with necessary diagram, the thermal evaporation method for depositing nanostructured thin films. 4

*Or*

Discuss the ball milling technique with necessary sketch. What are the advantages of this technique? 3+1=4

**4.** *(a)* What is an atomic force microscope? 2

*Or*

Why is optical microscope not suitable for characterization of nanomaterials? What do you mean by resolution of a microscope?

*(b)* Explain with necessary diagram, the working principle of SEM. 4

**5.** Answer any *three* of the following questions : 3×3=9

*(a)* What is Coulomb interaction in solids? How is dielectric confinement related to the Coulomb interaction?

*(b)* What is excitonic Bohr radius? How does dielectric constant affect the excitonic Bohr radius of a semiconductor material?

*(c)* What are the radiative and non-radiative electron-hole recombination processes in semiconductor nanoparticles?

*(d)* Write about optical properties of nano-structures.

**6.** *(a)* What do you mean by thermionic emission? Give an example where thermionic emission takes place. 1+1=2

*(b)* Explain the Coulomb blockade effect. What conditions must be satisfied for this effect to be observed? 2+2=4





**7.** Answer any *three* of the following questions : 4×3=12

*(a)* Why are quantum dots identified as attractive candidates to be applied for LED devices? Describe the basic structure of quantum dot LED with suitable diagram.

*(b)* Discuss the CNT-based transistor with necessary diagram. Write the advantages of CNT-based transistor over semi-conductor field effect transistor.

*(c)* What is meant by magnetic storage data? Name some magnetic storage devices. How does application of nano-technology improve the data storage capacity of magnetic storage device?

*(d)* Write a short note on nano-electromechanical system (NEMS).

*(e)* Write a short note on quantum dot heterostructure laser.

★★★

Total No. of Printed Pages—3

**6 SEM TDC DSE BOT (CBCS) 2 (H)**

**2022**

( June/July )

BOTANY

( Discipline Specific Elective )

( For Honours )

Paper : DSE–2

**( Natural Resource Management )**

*Full Marks* : 53
*Pass Marks* : 21

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** *(a)* Choose the correct answer of the following : 1×3=3

*(i)* Silent Valley is situated in

(1) Assam

(2) Kerala

(3) Africa

(4) South America

(ii) Which of the following is non-renewable source of energy?

(1) Fossil fuel

(2) Water

(3) Solar energy

(4) Forest

(iii) Sheet erosion is caused by

(1) fast running rivers

(2) wind

(3) heavy rains

(4) glaciers

(b) Fill in the blanks : 1×2=2

(i) The National Forest Policy was introduced in the year _____.

(ii) The Chipko Movement was started by _____.

**2.** Write short notes on the following : 3×4=12

(a) Sustainable development

(b) Non-renewable energy

(c) Biodiversity hotspot

(d) Objectives of IUCN





**3.** Write explanatory notes on any *two* of the following : 6×2=12

(a) Present status and causes of deforestation in India

(b) National biodiversity action plan

(c) Carbon footprint

(d) In-situ and ex-situ conservation

**4.** Define the term 'wetlands'. What are the four major types of wetland? Describe briefly about the importance and management strategies of wetlands. 1+2+4+5=12

*Or*

What do you mean by biodegradable and non-biodegradable wastes? Describe briefly the impacts of waste accumulation on the environment and write the different steps of its management. 2+5+5=12

**5.** Define wasteland or problem soil. Discuss various causes of soil degradation and its impact on the environment. 2+4+6=12

*Or*

What do you mean by conservation? What are their aims? Write about the national and international efforts in natural resource management and their conservation. 1+2+9=12

★★★

**6 SEM TDC DSE MTH (CBCS) 3 (H)**

**2022**

( June/July )

MATHEMATICS

( Discipline Specific Elective )

( For Honours )

Paper : DSE–3

**( Discrete Mathematics )**

*Full Marks* : 80
*Pass Marks* : 32

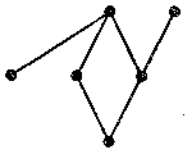
*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** *(a)* Define an ordered set with an example. 1+1=2

*(b)* Show that the sets $\mathbb{N} \cup \{0\}$ and $\mathbb{N}$, where $\mathbb{N}$ is the set of natural numbers, are order-isomorphic. 3

(c) Let the ordered set $P$ be given by the following Hasse diagram :



Find the dual of $P$. 2

(d) What is an order-preserving map? Give an example of a map which is order-preserving but not order-embedding. 1+2=3

**2.** (a) Answer any *one* of the following : 3

(i) Let $P$ be a lattice and $a, b, c \in P$. Then show that $a \leq b \Rightarrow a \vee c \leq b \vee c$ and $a \wedge c \leq b \wedge c$.

(ii) Let $L$ be a lattice and $a, b \in L$. Then show that $a \vee (a \wedge b) = a$.

(b) Find two non-trivial sublattices of the lattice $(P(X), \subseteq)$, where $X = \{1, 2, 3\}$ and $P(X)$ denotes the power set of $X$. 2

(c) Define a lattice isomorphism. 1

(d) Let $L$ and $K$ be two lattices and let $f : L \to K$ be a map. Show that the map $f$ is a lattice isomorphism if and only if it is an order-isomorphism. 4





*Or*

Define a complete lattice. Show that every finite lattice is complete. 1+3=4

(e) Answer any *one* of the following : 5

(i) Let $X$ be a set and $\Omega$ be a family of subsets of $X$, ordered by inclusion such that for every non-empty family $\{A_i\}_{i \in I} \subseteq \Omega$, the intersection $\bigcap_{i \in I} A_i \in \Omega$ and $X \in \Omega$. Then show that $(\Omega, \subseteq)$ is a complete lattice.

(ii) Let $L$ be a lattice. Then prove that $L$ is a chain if and only if every non-empty subset of $L$ is a sublattice.

**3.** (a) Give an example of—

(i) a modular lattice which is not distributive;

(ii) a lattice which is neither modular nor distributive. 1+1=2

(b) Show that in a distributive lattice complement of an element, if exists, is unique. 3

(c) Let $L$ be a Boolean lattice. Show that

$$(a \vee b)' = a' \wedge b'$$
$$(a \wedge b)' = a' \vee b' \; \forall \; a, b \in L$$ 4

(d) Let $B$ and $C$ be two Boolean algebras and $f : B \to C$ be a lattice homomorphism. Then show that the following are equivalent : 4

(i) $f(0) = 0$ and $f(1) = 1$

(ii) $f(a') = (f(a))' \; \forall \; a \in B$

(e) Obtain the sum-of-product canonical form of the Boolean polynomial $(x_1 + x_2)x_3$ in the variables $x_1$, $x_2$ and $x_3$. 2

(f) Answer any *two* of the following : 5×2=10

(i) Show that a lattice $L$ is non-modular if and only if $L$ has a sublattice isomorphic to the pentagon lattice $N_5$.

(ii) Obtain a minimal expression for the Boolean polynomial

$$ab'c' + abc' + a'b'c + a'bc'$$

using Karnaugh map.

(iii) Obtain a minimal expression for the Boolean polynomial

$$abc + abc' + a'bc' + a'b'c$$

using Quine-McCluskey algorithm.

4. (a) Define a connected graph. 1

(b) Find the number of edges of the graph $K_{8,10}$. 2





(c) Answer any *three* of the following : 3×3=9

(i) Show that in a graph the number of odd vertices is even.

(ii) Show that the maximum number of edges in a connected simple graph with $n$ vertices is $\frac{n(n-1)}{2}$.

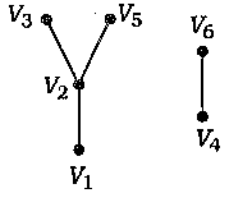
(iii) State three necessary conditions for isomorphism of two graphs.

(iv) Show that a bipartite graph cannot contain an odd cycle.

(d) Prove or disprove : 2

If a graph $G$ is Eulerian, then $G$ is also Hamiltonian.

(e) Find the adjacency matrix of the graph shown below : 2

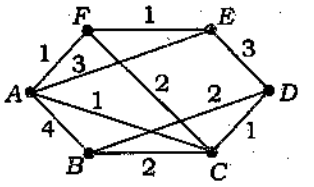



5. Answer any *two* of the following : 7×2=14

(a) Show that a connected graph $G$ is Eulerian if and only if every vertex of $G$ is even.

*(b)* If a graph $G$ has $n \geq 3$ vertices and every vertex has degree at least $\frac{n}{2}$, then show that $G$ is Hamiltonian.

*(c)* Find the shortest path between the vertices $A$ and $D$ from the following weighted graph using Dijkstra's algorithm :




*(d)* Discuss Floyd-Warshall algorithm with an example.

★★★

Total No. of Printed Pages—3

# 6 SEM TDC DSE ZOO (CBCS) 3 (H)

## 2022

( June/July )

ZOOLOGY

( Discipline Specific Elective )

( For Honours )

Paper : DSE–3

**( Immunology )**

*Full Marks* : 53
*Pass Marks* : 21

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** Fill in the blanks : 1×5=5

*(a)* Substances added to the vaccines to increase its immunogenicity are called _____.

*(b)* The state of unresponsiveness of the immune system to a potential antigen is known as _____.

(c) _____ is the scientist who proposed clonal selection theory.

(d) _____ is released due to degranulation of Mast cells.

(e) Immunoglobulines are produced by _____ cells.

**2.** Write short notes on (any *three*) : 4×3=12

(a) Inflamation

(b) RNA vaccine

(c) Antigen-antibody interaction

(d) RIA

(e) Cytokines

**3.** Differentiate between (any *three*) : 4×3=12

(a) Active and Passive immunity

(b) Humoral and Cellular immune response

(c) Innate and Acquired immunity

(d) MHC class I and class II molecules

(e) B-lymphocytes and T-lymphocytes epitopes



( Continued )



**4.** Describe 'hybridoma technology' for production of monoclonal antibodies. Also mention the applications of monoclonal antibodies. 8+4=12

*Or*

Describe briefly the structure and functions of different classes of immunoglobulins. 6+6=12

**5.** Define Antigen. Differentiate between antigenicity and immunogenicity. Also mention factors affecting immunogenicity. 2+6+4=12

*Or*

Describe briefly the components of complement system. Explain the classical pathway for complement activation. 6+6=12

★★★