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VI Semester B.Sc. Degree Examination, September/October 2020

(CBCS)

ZOOLOGY

Paper Z 6.2 – Ethology, Evolution and Zoogeography

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer **all** Sections.*

2) Draw labelled diagrams wherever necessary.

SECTION – A

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

1. Define irritability and kinesis.
2. What are analogous organs? Give example.
3. What are barriers?
4. Define frequency and genetic drift.
5. What do you mean by phototropism and Heliotropism?
6. Define monogamy and polygamy.

SECTION – B

A. Answer **any four** of the following : **(4 × 5 = 20)**

7. Write a short note on parental care in Amphibians with suitable examples.
8. Briefly explain the social organization in Honey bee.
9. Describe the causes and advantages of migration in birds.
10. Write a short note on catadromous migration with suitable examples.
11. Give an account of an experiment of Pavlov on Dogs for conditional reflex.
12. Explain briefly about Mullarian and Batesian mimicry with examples.

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

13. Describe the principles of Hugo De Vries theory of evolution.

14. Explain briefly about the mechanism of speciation.

15. Write a short note on Allopatric speciation.

SECTION – C

A. Answer **any two** of the following : **(2 × 10 = 20)**

16. Describe the different kinds of parental care in Fishes with examples.

17. Briefly explain the principles of courtship behaviour. Add a note on courtship behaviour in Scorpion and Frog.

18. Explain the detail account of Insight learning with example.

B. Answer **any one** of the following : **(1 × 10 = 10)**

19. Give a detailed note on Anatomical evidences of Evolution in favour of organic evolution.

20. Describe Stanley Miller's experiment to prove the theory of the chemical evolution of life with a neat labelled diagram.

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VI Semester B.Sc. Degree Examination, September/October 2020

BOTANY

Paper 6.2 – Plant Physiology

(CBCS – New Syllabus)

Time : 3 Hours | Max. Marks : 70

Instructions :

1) *Answer all Sections.*
2) *Draw diagrams wherever necessary.*

SECTION – A

I. Answer the following : **(15 × 1 = 15)**

1. What is Imhibition?
2. Define R.Q.
3. What is an incipient plasmolysis?
4. Define respiration.
5. What is terminal oxidation?
6. What are Quantosomes?
7. Expand ATP and NAD.
8. Define Ascent of sap.
9. Define growth.
10. What is turgor pressure?
11. What is cohesion?
12. What are raw materials for photosynthesis?

P.T.O.

13. What is passive absorption of water?

14. Name the site of glycolysis in the cell.

15. What is root pressure?

SECTION – B

II. Answer **any five** of the following : **(5 × 5 = 25)**

16. Describe cyclic photophosphorylation.

17. Explain Munch's mass flow hypothesis.

18. Explain the mechanism of active absorption of water.

19. Explain the starch-sugar inter-conversion theory.

20. Differentiate aerobic and anaerobic respiration.

21. What are Auxins? Write their role in tropic movement.

22. Write a short note on :
    (a) Guttation
    (b) Fermentation

SECTION – C

III. Answer **any three** of the following : **(3 × 10 = 30)**

23. Explain Hach and Slack cycle with schematic representation.

24. Explain the EMP pathway in the process of respiration.

25. What is Enzyme? Explain the mechanism of enzyme action.

26. What is transpiration? Discuss transpiration is necessary evil.

27. Describe Melvin-Calvin cycle.

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VI Semester B.Sc. Degree Examination, September/October 2020

BOTANY

Paper 6.1 – Plant Breeding, Biotechnology and Plant Tissue Culture

(CBCS – New)

Time : 3 Hours | Max. Marks : 70

Instructions :

1) *Answer all Sections.*

2) *Draw diagrams wherever necessary.*

SECTION – A

I. Answer the following : **(15 × 1 = 15)**

1. What is pure line selection?

2. What is Pollen bank?

3. Define explant.

4. What is grafting?

5. Define DNA Ligase.

6. What is Quarantine method?

7. What are restriction sites?

8. What is bagging?

9. What are polyclonal antibodies?

10. What are cryoproteins?

11. Define dedifferentiation.

12. What are YAC's?

P.T.O.

13. What are intraspecific hybridization?

14. What is stem cell culture?

15. Expand LAF.

SECTION – B

II. Answer **any five** of the following : **(5 × 5 = 25)**

16. Write note on Gene therapy.

17. Mention the applications of tissue culture in agriculture.

18. Describe with neat labelled diagram of PBR^{322}.

19. Mention the principles and objectives of plant breeding.

20. Explain how hybridization technique helps in the production of new varieties.

21. Write a note on DNA fingerprinting technique.

22. Write a note on recurrent selection.

SECTION – C

III. Answer **any three** of the following : **(3 × 10 = 30)**

23. Bt cotton is an example for transgenic plant. Justify.

24. Explain the different types of grafting.

25. Explain any two methods of plant breeding selection.

26. What is haploid culture? Describe anther culture.

27. What is somatic embryogenesis? Explain the process of production of somatic embryos.

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VI Semester B.Sc. Degree Examination, September/October 2020

(CBCS)

ZOOLOGY

Paper Z 6.1 – Genetics and Bio-Technology

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer **all** the questions.*

2) Draw neat labelled diagrams wherever necessary.

SECTION – A

Answer **any five** of the following in **2** or **3** sentences each : **(5 × 2 = 10)**

1. Define Codominance.
2. What is meant by Daltonism?
3. Define agglutination.
4. What is Gynandromorph?
5. Write the central dogma of protein synthesis.
6. What is RENase? Write its function.

SECTION – B

PART – A

Write short note on **any four** of the following : **(4 × 5 = 20)**

7. Explain briefly about Haemophilia and its inheritance.
8. Write a brief note on 44 + XXY syndrome.
9. Describe the salivary gland chromosome with neat labelled diagram.
10. Explain the mechanism of sex-determination in Drosophila melanogaster.
11. Write a short note on lethal genes and their inheritance in rats.
12. Describe the genetic aspects of human blood groups.

PART – B

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

13. Discuss the physio chemical properties of Watson and Crick model of DNA.

14. List the properties of genetic code.

15. Enumerate the applications of Genetic engineering.

SECTION – C

PART – A

Answer **any two** of the following in detail : **(2 × 10 = 20)**

16. Discuss the inheritance of supplimentary factors by taking an appropriate example in detail.

17. Explain in detail about the polygenic inheritance in man by taking skin colour as an example.

18. Substantiate the structure of chromosomes with the help of different models.

PART – B

Answer **any one** of the following in detail : **(1 × 10 = 10)**

19. Explain Griffith's experiment along with supporting evidence.

20. Describe the mechanism of bio-synthesis of proteins in animals.

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VI Semester B.Sc. Degree Examination, September/October 2020

CHEMISTRY – VII

Paper 6.1

(CBCS)

Time : 3 Hours

Max. Marks : 70

Instructions :

1) *Section-A contains questions from Inorganic, Organic and Physical Chemistry.*

2) *Section-B contains questions from Inorganic Chemistry, Section-C contains questions from Organic Chemistry and Section-D contains questions from Physical Chemistry.*

3) *Answer all the four Sections A, B, C and D.*

SECTION – A

Answer **any ten** of the following questions : **(10 × 1 = 10)**

1. What is a Clinker?

2. What is annealing of glass?

3. What is the role of pigment in paints?

4. Define inorganic polymers.

5. Write the structure of atropine.

6. What are hormones?

7. Write the structure of Quinine.

8. What is dipeptide?

9. What do you mean by polarizability?

10. State sedation rule.

11. Give the wavelength range of rotational spectra.

12. What is meant by degeneracy?

P.T.O.

SECTION – B

Answer **any two** of the following questions : **(2 × 10 = 20)**

13. (a) Explain the manufacture of glass by pot furnace. **(6)**

    (b) Write a note on cement industries in India. **(4)**

14. (a) Explain the method of preparation and applications of silicones. **(6)**

    (b) Write a note on industrial effluents, their effect and treatment. **(4)**

15. (a) Discuss

    (i) Constituents of paints

    (ii) Setting of paints **(6)**

    (b) Explain types and sources of air pollution. **(4)**

SECTION – C

Answer **any two** of the following questions : **(2 × 10 = 20)**

16. (a) What are alkaloids? How they are classified? **(6)**

    (b) Explain the mechanism of enzyme action by Lock and Key model. **(4)**

17. (a) Elucidate the structure of citral. **(6)**

    (b) Explain the biological importance of thyoroxin and insulin. **(4)**

18. (a) What are Vitamins? Write the biological importance of Vitamin A, B and C. **(6)**

    (b) Give the synthesis of dipeptide glycylalanine. **(4)**

SECTION – D

Answer **any two** of the following questions : **(2 × 10 = 20)**

19. (a) Write a note on vibrational spectra of Anharmonic oscillator. **(6)**

    (b) The separation of rotational spectral lines occurred at 332 m^{-1} for NO molecule. Calculate the internuclear bond length.

    Reduced mass of NO = 1.24×10^{-26} kg, $h = 6.626 \times 10^{-34}$ Js. **(4)**

20. (a) Write a note on pure rotational Raman spectra of a diatomic molecule. **(6)**

(b) Explain how is force constant. Calculate in case of vibrational spectra. **(4)**

21. (a) Derive energy expression and write energy level diagram for rotational spectrum of rigid diatomic molecule. **(6)**

(b) Write a note on basic features of different spectrometer. **(4)**

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VI Semester B.Sc. Degree Examination, September/October 2020

CHEMISTRY

Paper 6.2

(CBCS)

Time : 3 Hours Max. Marks : 70

Instructions :

1) *Section-A contains questions from Inorganic, Organic and Physical Chemistry.*

2) *Section-B contains questions from Inorganic Chemistry, Section-C contains questions from Organic Chemistry and Section-D contains questions from Physical Chemistry.*

3) *Answer all the four Sections A, B, C and D.*

SECTION – A

Answer **any ten** of the following questions : **(10 × 1 = 10)**

1. Give the IUPAC name of the $Fe(CO)_5$.

2. What are the composites?

3. Define EAN Rule.

4. What are essential trace elements?

5. Give one example of contaminants in food materials.

6. Write one use of Gammexane.

7. Define chemotherapy.

8. What are Heterocyclic compounds?

9. What are Irreversible cells?

10. Define an electrode.

11. What are concentration cells?

12. What are Galvanic cells?

SECTION – B

Answer **any two** of the following questions : (2 × 10 = 20)

13. (a) Describe the mechanism of Ziegler-Natta catalysis. (6)

(b) Write any two methods of preparation of Organo-Aluminium compounds. (4)

14. (a) Describe the structure and function of Myoglobin. (6)

(b) Write a note on carbonic-anhydrase. (4)

15. (a) Explain Fe-C phase transformation in Ferrous alloys. (6)

(b) Write a note on classification of materials. (4)

SECTION – C

Answer **any two** of the following questions : (2 × 10 = 20)

16. (a) Describe the molecular orbital picture and aromaticity of pyridine. (6)

(b) Write two methods of synthesis of pyrrole. (4)

17. (a) Describe the chlorinated pesticide analysis in food products by TLC technique. (6)

(b) How do you analyse moisture in spices? (4)

18. (a) Explain the classification of Drugs. (6)

(b) Write the synthesis of Antipyrine. (4)

SECTION – D

Answer **any two** of the following questions : (2 × 10 = 20)

19. (a) Derive an expression for EMF of the concentration cell without transference. (6)

(b) Write a note on liquid-junction potential. (4)

20. (a) Describe the construction and working of Weston standard cell. **(6)**

(b) Write a note on potentiometric Redox titrations. **(4)**

21. (a) Explain the construction and working of Hydrogen-Oxygen fuel cell. **(6)**

(b) Write a note on Calomel electrode. **(4)**

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VI Semester B.Sc. Degree Examination, September/October 2020

PHYSICS

Paper 6.1 – Nuclear Physics, Solid State Physics, Astrophysics and Bio Physics

(CBCS)

Time : 3 Hours | Max. Marks : 70

Instructions : *Answer* ***all*** *questions from Section A in first two pages only.*

SECTION – A

Answer the following : **(15 × 1 = 15)**

1. What is mass defect of a nucleus?
2. Define decay constant.
3. Define Dead time of a G.M. Counter.
4. What is nuclear fusion?
5. What are thermo nuclear reactions?
6. What are conventional energy sources?
7. What is Bravais lattice?
8. What is Miller Indices?
9. What is a crystal structure?
10. How a susceptibility of a para magnetic material varies with temperature?
11. Define Magnetic moment.
12. What is hysteresis loop in magnetism?
13. What is critical temperature of a super conductor?
14. What are High temperature super conductors?
15. What are Black holes?

SECTION – B

Answer **any five** of the following : **(5 × 5 = 25)**

16. Explain the liquid drop model of a nucleus.

17. State Radioactive decay law and obtain the expression of radio active decay of nuclei.

18. Give the theory of Betatron.

19. State and derive Bragg's law of X-ray diffraction.

20. Explain Einstein's theory of specific heat of solids.

21. Explain Soft and Hard super conductors.

22. Write a note on formation and evolution of stars.

SECTION – C

Answer **any three** of the following : **(3 × 10 = 30)**

23. (a) What is a nuclear force? Give its characteristics.

    (b) Define Half life and Mean life of a radio active element and obtain the relation between them.

    (c) Find the Radioactive constant of a Radium whose Half life period is 1662 years and hence find its mean life. **(5 + 3 + 2)**

24. (a) Explain the limitations of a cyclotron.

    (b) In a certain cyclotron the maximum radius that the path of a deuteron may have before it is deflected out of the magnetic field is 0.2 m, (i) Calculate the velocity of a deuteron at this radius (ii) What is the energy of deuteron? Given : Magnetic field $= 1.5\ W/m^2$, Mass of the deuteron $= 3.34 \times 10^{-27}$ kg and $q = 1.6 \times 10^{-19}$ C.

    (c) Distinguish between Diamagnetic, Paramagnetic and Ferromagnetic materials. **(3 + 2 + 5)**

25. (a) Write a note on Bio gas plant.

(b) Explain the theory of nuclear reactors. **(5 + 5)**

26. (a) Obtain an expression for electrical conductivity of metals.

(b) Explain Dulong and Petits law of specific heat of solids. **(5 + 5)**

27. (a) Explain Meissner effect.

(b) Explain Hertzsprung-Russel diagram. **(5 + 5)**

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VI Semester B.Sc. Degree Examination, September/October 2020

PHYSICS

Paper 6.1 – Nuclear Physics, Solid State Physics, Astrophysics and Bio Physics

(New)

Time : 3 Hours | Max. Marks : 70

Instructions : *Answer* ***all*** *questions from Section A in first two pages only.*

SECTION – A

Answer the following : **(15 × 1 = 15)**

1. State Dulong and Petit's law.
2. What is Debye temperature?
3. What is Ferro magnetism?
4. What is hysteresis loop in magnetism?
5. What is Curie's temperature?
6. What is super conductivity?
7. Define light year.
8. Define Luminosity of a star.
9. What is Bio physics?
10. Define membrane potential of a cell.
11. What are nucleic acids?
12. Define specific Binding energy of a nucleus.
13. What is a particle accelerator?
14. What are thermal nuclear reactions?
15. What is nuclear fission?

SECTION – B

Answer **any five** of the following : **(5 × 5 = 25)**

16. What is a nuclear force? Give the characteristics of nuclear forces?

17. Explain the characteristics of Alpha, Beta and Gamma particles.

18. Write a note on Miller Indices.

19. Deduce an expression for electrical conductivity of metal.

20. Write the application of Superconductors.

21. Write a note on spectral classification of stars.

22. Explain four basic interactions in nature.

SECTION – C

Answer **any four** of the following : **(4 × 10 = 40)**

23. (a) Write a note on liquid drop model of the nucleus.

    (b) State the Radioactive decay law and obtain the expression $N = N_0 e^{-\lambda t}$. **(5 + 5)**

24. Explain construction, working and the theory of a cyclotron. **(10)**

25. (a) Write a note on Wind and Tidal energy.

    (b) Explain how Biogas is produced from Biogas plant. **(5 + 5)**

26. (a) Obtain the expression for thermal conductivity of metals.

    (b) Distinguish between Dia magnetic, paramagnetic and Ferro magnetic materials. **(5 + 5)**

27. (a) Write a note on Type I and Type II super conductors.

    (b) Explain H.R. diagram. **(5 + 5)**

28. (a) What are orgeneller constituents of cell? Explain.

    (b) Write any two differences between plant cells and animal cells.

    (c) X-rays of wavelength 0.71 Å are reflected from (1, 1, 0) plane of a rock salt lattice constant is 2.82 Å. Calculate the glancing angle corresponding to 2^{nd} order. **(5 + 2 + 3)**

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VI Semester B.Sc. Degree Examination, September/October 2020

PHYSICS

Paper VIII (6.2) – Material Science and Electronics – II

(New)

Time : 3 Hours Max. Marks : 80

Instructions : *1) Answer **all** the questions from Section A in the first two pages only.*

*2) Answer **any five** questions of Section B and **four** questions from Section C.*

SECTION – A

I. Answer **all** the following : **(15 × 1 = 15)**

1. Write one mechanical property of polymer.
2. Define ionic bonding in materials.
3. Define lateral strain.
4. Write the expression for thermal conductivity in metal.
5. Define thin film.
6. Give one example for Quantum dot.
7. Write the size of the red blood cell – RBC.
8. What is Amplifier?
9. Define h-parameters.
10. What is negative feedback?
11. Define Astable multivibrator.
12. Convert the binary number 100 to Decimal number.
13. Define flip flop.
14. Define frequency modulation.
15. What is dynamic range?

SECTION – B

II. Answer **any five** of the following : **(5 × 5 = 25)**

16. Explain ionic bonding in materials with example.

17. Write a note on strength of the material.

18. Derive an expression for electrical conductivity of metals.

19. Explain equivalent circuit of common emitter amplifier using hybrid parameters.

20. Explain working of Hartley oscillator.

21. Write a note on flip flop.

22. Explain Amplitude modulation of a wave.

SECTION – C

III. Answer **any four** of the following : **(4 × 10 = 40)**

23. (a) Explain engineering requirement of materials.
    (b) Compare crystalline and non crystalline state of materials. **(5 + 5)**

24. (a) Write a note on fracture.
    (b) Derive an expression for thermal conductivity of metals. **(5 + 5)**

25. (a) Write the applications of thin film.
    (b) Explain the Technique of synthesis of nano materials. **(5 + 5)**

26. (a) Explain single stage common emitter amplifier.
    (b) Write a note on multivibrator. **(5 + 5)**

27. (a) Explain OR and AND gate using diode and transistor with truth table.
    (b) Explain Full adder with neat diagram and truth table. **(5 + 5)**

28. (a) Explain modulation factor of a wave.
    (b) Describe superheterodyne receiver with neat block diagram. **(5 + 5)**

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VI Semester B.Sc. Degree Examination, September/October 2020

PHYSICS

Paper VIII (6.2) – Material Science and Electronics – II

(CBCS)

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer* ***all*** *the questions from Section A in the first two pages only.*

2) Answer ***any five*** *questions from Section B and* ***three*** *questions from Section C.*

SECTION – A

I. Answer **all** of the following : **(15 × 1 = 15)**

1. What is ceramic?
2. Define metallic bonding in material.
3. Define longitudinal strain.
4. Define thin film.
5. Name any one method of preparation of thin film.
6. Give one example for Quantum dot.
7. Define negative feedback of the oscillator.
8. Write one Barkhausen criterion for steady oscillations.
9. What is Bi-stable multivibrator?
10. Define XOR gate.
11. Define Flip Flop.
12. Convert the binary number 11,101 to Decimal number.
13. Define modulation of wave.
14. Define bandwidth of wave.
15. Define selectivity of the radio receiver.

SECTION – B

II. Answer **any five** of the following : **(5 × 5 = 25)**

16. Explain covalent bonding in materials with example.

17. Write a note on strength of the material.

18. Derive an expression for electrical conductivity of metals.

19. Explain the Technique of synthesis of nano materials.

20. Explain the working of Colpitt's oscillator.

21. Explain OR and AND gate using diode and transistor with truth table.

22. Explain Amplitude modulation.

SECTION – C

III. Answer **any three** of the following : **(3 × 10 = 30)**

23. (a) Explain engineering requirements of materials.

    (b) Compare crystalline and non crystalline state of materials. **(5 + 5)**

24. (a) Explain ionic bonding in materials with example.

    (b) Write a note on fracture. **(5 + 5)**

25. (a) Describe an experiment for the preparation of thin film by sputtering technique.

    (b) Write the applications of nano materials. **(5 + 5)**

26. (a) Explain the working of phase shift oscillator.

    (b) Explain full adder with neat diagram and truth table. **(5 + 5)**

27. (a) Describe super heterodyne receiver with neat block diagram.

    (b) A 500 W, 100 kHz carrier is modulated to a depth of 60% by modulating signal of frequency 1 kHz. Calculate the total power transmitted. What are the side band components of the wave? **(6 + 4)**

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VI Semester B.Sc. Degree Examination, September/October 2020

MATHEMATICS

Paper XII (6.1) – Trigonometry, Topology and Fuzzy Sets

Time : 3 Hours Max. Marks : 80

Instructions : *Answer* ***all*** *Sections.*

SECTION – A

Answer **any ten** of the following : **(10 × 2 = 20)**

1. Define a Topology on a set with example.
2. Show that an open interval is an open set in (R, u).
3. Prove that A singleton set $\{x\}$ is not an open set in $\{R, u\}$.
4. Prove that in a discrete topology (X, τ) every subset of X is closed.
5. Give an example to show that any union of closed sets need not be closed.
6. If A is closed and B is open then prove that $A - B$ is closed.
7. Define derived set with example.
8. Prove that $\sinh(ix) = i \sin x$.
9. Prove that $\sinh 3x = 3\sinh x + 4\sinh^3 x$.
10. Separate Real and Imaginary parts of $\sin(x + iy)$.
11. Define union and intersection of two fuzzy subsets.
12. Define α-cut and strong α-cut set of fuzzy subset A with an example each.

SECTION – B

Answer **any five** of the following : **(5 × 6 = 30)**

13. Let X be any set, τ be family of subsets of X defined as follows.

    A subset G of X belongs to τ ie $G \in \tau$ iff, (a) G is empty 'OR' (b) G' is finite then, prove that τ is a topology on X.

14. Let (X,τ) be a topological space, Let $A, B \subset X$ then prove that, (a) $A \subset \overline{A}$ (b) $\overline{A}$ is closed (c) $\overline{A}$ is the smallest closed set containing A (d) A is closed iff $A = \overline{A}$.

15. Let (X, τ) be a topological space A and B are subsets of X then prove that (a) $d(\phi) = \phi$ (b) If $A \subset B$ then $d(A) \subset d(B)$.

16. Let (X, τ) be a topological space, A and B are subsets of X then (a) $A^\circ \subset A$ (b) A° is the union of all open sets contained in A and hence it is an open set (c) A° is the largest open set contained in A if $B \subset A$ and B is open then $B \subset A^\circ$ (d) A is open iff $A = A^\circ$.

17. Let (X,τ) be a topological space and $A \subset X$, which is neither empty nor singleton, Find $d(A)$.

18. Let $X = \{a,b, c, d, e\}$ and $\tau = \{\phi, X, \{a\},\{a,b\},\{a, b, c\}\{a, b,c, d\}\}$ be a topology of X. Find A°, $(A')^\circ$, $\partial(A)$ where $A = \{a,c, d\}$.

19. Prove that every finite T_1-space is discrete space.

SECTION – C

Answer **any five** of the following : **(5 × 6 = 30)**

20. Show that $\text{cosec}(i\,x) = -i\,\text{cosec}\,h\,x$.

21. Expand $\cos 8\theta$ interms of powers of $\sin\theta$ and $\cos\theta$.

22. Find Real and Imaginary parts of $\sin(x+iy)$.

23. Sum the series

$$1+\frac{\cos\theta}{1!}+\frac{\cos 2\theta}{2!}+\frac{\cos 3\theta}{3!}+\ldots \text{ upto } \infty.$$

24. Let us prove that

$$\log\left[\frac{\cos(x-iy)}{\cos(x+iy)}\right] = zi\tan^{-1}[\tan x\ \tanh y].$$

25. Let A and B two fuzzy subsets of X. Let $\alpha, \beta \in [0, 1]$ then prove that

(a) $\alpha_{(A \wedge B)} = \alpha_A \cap \alpha_B$

(b) $\alpha_{(A \vee B)} = \alpha_A \cup \alpha_B$

26. Let $X = \{a, b, c, d, e\}$, $A = \{(a, 0), (b, 0, 2), (c, 0, 6), (d, 1), (e, 0, 5)\}$.

Find all α-cutsets and strong α-cutsets of A where $\alpha = 0.4, 0.2, 1$.

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VI Semester B.Sc. Degree Examination, September/October 2020

MATHEMATICS

Paper XII (6.1) – Trigonometry, Topology and Fuzzy Sets

(CBCS)

Time : 3 Hours Max. Marks : 70

Instructions : *Answer* ***all*** *Sections.*

SECTION – A

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

1. Define Comparable topologies with example.

2. If A is closed and B is open then prove that $A - B$ is closed.

3. Give an example to show that $\overline{A \cap B} \neq \overline{A} \cap \overline{B}$.

4. Prove that $\cosh(3x) = 4\cosh^3 x - 3\cosh x$.

5. Find Real and Imaginary parts of $\sin(x + iy)$.

6. Define Fuzzy subset with an example.

7. Define α-cut and strong α-cut set of Fuzzy subset A with an example each.

SECTION – B

Answer **any five** of the following : **(5 × 6 = 30)**

8. Let R be the set of all real Numbers and u be the family of subsets of R defined as (i) $A = \phi$ 'OR' if A is non empty then for every $x \in A$, $\exists$ an open interval I, such that $x \in I \subset A$ then prove that u is a topology on R.

9. Let (X, τ) be a topological space A, B be subsets of X then prove that

   (a) $d(\phi) = \phi$

   (b) If $A \subset B$ then $d(A) \subset d(B)$.

10. Let (X, τ) be a topological space. A is subset of X, If $x \in X$ is a limit point of A then prove that every neighbourhood of x contains a point of A other than x.

11. Let (X, τ) be a topological space (discrete) and A is any subset of X, Find $d(A)$.

12. Let $X = \{a, b, c, d, e\}$, $\tau = \{\phi, X, \{a\}, \{a, b\}, \{a, b, c\}, \{a, b, c, d\}\}$ be a topology on X. Then find A°, $(A')^\circ$, $\partial(A)$, where $A = \{a, b, e\}$.

13. Let (X, τ) be a topological space, Let $A \subset X$ then,

    (a) $A \cup d(A)$ is closed

    (b) $A \cup d(A) = \overline{A}$

14. Prove that every finite T_1-space is discrete space.

SECTION – C

Answer **any five** of the following in detail : **(5 × 6 = 30)**

15. Expand $\sin^8 \theta$ interms of cosines of multiples of θ.

16. Show that $16 \sin^5 \theta = \sin 5\theta - 5 \sin 3\theta + 10 \sin \theta$.

17. Find the sum of the Series $\cos\alpha + \cos(\alpha + \beta) + \cos(\alpha + 2\beta)$ + to n terms.

18. Prove that $i \log\left(\frac{x+i}{x-i}\right) = 2\tan^{-1} x - \pi$.

19. Expand $\cos 7\theta / \cos\theta$ as a series in powers of $\cos\theta$.

20. Let X be a set and A be Fuzzy subset of X, Let $\alpha, \beta \in [0, 1]$ then prove that

    (a) $\alpha \leq \beta \Rightarrow \beta_A \subset \alpha_A$

    (b) $\alpha \leq \beta \Rightarrow \alpha_A \vee \beta_A = \alpha_A$ and
    $\alpha_A \cap \beta_A = \beta_A$

21. Explain operations on Fuzzy subsets.

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MATHEMATICS

Paper XIII (6.2) – Numerical Analysis

(New)

Time : 3 Hours Max. Marks : 80

Instructions : *Answer* ***all*** *Sections.*

SECTION – A

I. Answer **any ten** of the following : **(10 × 2 = 20)**

1. If true value of a Number is 36.25 and its absolute error is 0.002, find the relative error and percentage error.

2. Find the number of trustworthy figures in $(476)^{1/5}$ where 476 is correct to three significant figures.

3. Find the interval in which the real root lies $x^3 - 4x - 9 = 0$.

4. Construct the forward difference table given that

x:	5	10	15	20	25	30
y:	9962	9848	9659	9397	9063	8660

and write the values of $\Delta^2 y_{10}$ and $\Delta^3 y_5$.

5. Evaluate $\left(\frac{\Delta^2}{E}\right) x^3$ by choosing $h = 1$.

6. Prove that $\nabla = E^{-1}\Delta$.

7. State Newton's Forward interpolation formula.

8. If $u_0 = 3$, $u_1 = 12$, $u_2 = 81$, $u_3 = 2000$, $u_4 = 100$, $u_5 = 8$, find the value of $\Delta^5(u_0)$.

9. Show that $y_3 = y_0 + 3\Delta y_0 + 3\Delta^2 y_0 + \Delta^3 y_0$.

10. Express $f(x) = 2x^3 - 3x^2 + 3x - 10$ in factorial notation taking $h = 1$.

11. State Weddle's rule for Numerical integration.

12. Using Picards method of successive approximation obtain the solution upto 2nd approximation of the equation $\frac{dy}{dx} = x + y$, given $y = 1$ when $x = 0$.

SECTION – B

II. Answer **any five** of the following : **(5 × 6 = 30)**

13. Find the relative error in the calculation of $\frac{2.087}{0.133}$ where the numbers 2.087 and 0.133 are correct to three decimal places. Determine the smallest interval in which the result holds.

14. Find a real root of the equation $x^3 - 9x + 1 = 0$ given that the root lies between 2 and 3 by Bisection method.

15. Find the real root of the equation $x^3 - 3x + 1 = 0$ lying between 1 and 2 correct to four decimal places by Newton Raphson's method.

16. Solve by Gauss Elimination method

$2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$.

17. Using Gauss-Seidal iteration method, solve the system of equations.

$27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$.

18. Using Factorial notation, find the polynomial whose 1st difference is $g(x) = 9x^2 + 11x + 5$.

19. The population of a town is as below :

Year :	1921	1931	1941	1951	1961	1971
Population in lakhs :	20	24	29	36	46	51

Find the increase in population during the 1955 to 1961.

SECTION – C

III. Answer **any five** of the following : **(5 × 6 = 30)**

20. Find $\log_{10} 310$ by Lagranges interpolation formula given that

$\log_{10} 300 = 2.4771$; $\log_{10} 304 = 2.4829$;

$\log_{10} 305 = 2.4843$; $\log_{10} 307 = 2.4871$.

21. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 54$ from the following table :

x :	50	51	52	53	54
$f(x)$:	3.6840	3.7084	3.7325	3.7563	3.7798

22. Find the approximate value of π applying Simpson's $\frac{1}{3}$rd rule to $\int_0^1 \frac{1}{1+x^2}\,dx$ dividing the range into 8 equal parts.

23. Using Taylor's series method, compute the solution of $\frac{dy}{dx} = x + y$, $y(0) = 1$, at $x = 0.2$ correct to decimal places.

24. Use Euler's method to calculate y for $x = 0.05$ and $x = 0.1$ given that $\frac{dy}{dx} = x + y$ with the initial condition $x_0 = 0$, $y_0 = 1$.

25. Calculate $\int_4^{5.2} \log x\,dx$ by using (a) Trapezoidal rule and (b) Weddle's rule taking step size 0.2.

26. Solve $\frac{dy}{dx} = x + y^2$ for $x = 0\,(0.2)\,0.4$ given that $y = 0$ when $x = 0$ by Runge-Kutta method.

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MATHEMATICS

Paper XIII (6.2) – Numerical Analysis

(CBCS – New)

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer* ***all*** *the Sections.*

2) Non-programmable calculator may be used.

SECTION – A

I. Answer **any five** of the following : **(5 × 2 = 10)**

1. Find the number of trustworthy figures in $(0.318)^3$ assuming that 0.318 correct to the last figure.

2. State the Bisection Method.

3. Construct the Forward difference table from the following data and find $\Delta^2 f(1)$ and $\Delta^3 f(1)$.

x :	0	1	2	3	4
$f(x)$:	1.0	1.5	2.2	3.1	4.6

4. Prove that $E = (1 - \nabla)^{-1}$.

5. Using Weddle's rule evaluate $\int_3^6 y_x \, dx$ from the following data :

	x_0	x_1	x_2	x_3	x_4	x_5	x_6
x :	3.0	3.5	4.0	4.5	5.0	5.5	6.0
y_x :	0.4771	0.5440	0.6020	0.6532	0.6996	0.7404	0.7782
	y_0	y_1	y_2	y_3	y_4	y_5	y_6

6. Evaluate $\int_{-3}^{3} x^4\,dx$ by Trapezoidal rule by choosing $h = 1$.

7. Using Picard's method solve $\frac{dy}{dx} = x + y$, $y(0) = 1$, at $x = 0.1$ upto 2nd approximation.

SECTION – B

II. Answer **any five** of the following : **(5 × 6 = 30)**

8. Find the real positive root of the equation $x \log_{10} x = 1.2$ between 2 and 3. Correct to three decimal places by Regula-Falsi method.

9. Solve $x^3 - x^2 - 2 = 0$ over (1, 2) by Secant method.

10. Find the real positive root of the equation $x^4 - x - 10 = 0$ between (1.5, 2) correct to three decimal places by Newton-Raphson's method.

11. Solve by Gauss-Elimination method :

$5x_1 - x_2 - 2x_3 = 142$, $x_1 - 3x_2 - x_3 = -30$, $2x_1 - x_2 - 3x_3 = 5$.

12. Solve by Jacobi's method :

$20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$.

13. The table gives the distance in Nautical miles of the visible horizon for the given heights in feet above the earth surface. Find the value of 'y' when $x = 218$ ft and 410 ft.

x = height	100	150	200	250	300	350	400
y = distance	10.63	13.03	15.04	16.81	18.42	19.90	21.27

14. Prove the identity

$$u_x = u_{x-1} + \Delta u_{x-2} + \Delta^2 u_{x-3} + \cdots + \Delta^n u_{x-n}$$

15. Express $f(x) = 3x^3 + 3x^2 - 5x - 5$ in Factorial Notation and also find its successive differences.

SECTION – C

III. Answer **any five** of the following : **(5 × 6 = 30)**

16. Find the real root of the equation $e^x = 5x$ that lies near $x = 0$ by using Aitken's Δ^2 method.

17. Use Gauss-Seidal Method to solve $5x - y = 9$, $x - 5y + z = -4$, $y - 5z = 6$.

18. Given :

x	1.96	1.98	2.00	2.02	2.04
y	0.7865	0.7739	0.7651	0.7563	0.7473

Find y' and y'' at 2.03.

19. Evaluate $\int_0^6 \frac{dx}{(1+x)^2}$ correct to 3 places of decimal in the step of 1 unit. Using Simpson's 1/3rd rule.

20. By using Simpson's $3/8^{th}$ rule with $h = 0.2$ find the approximate area under the curve $y = \frac{x^2 - 1}{x^2 + 1}$ between the ordinates $x = 1$ and $x = 2.8$.

21. Use Taylor's series method to solve $\frac{dy}{dx} = x + y$, $y(0) = 1$, at $x = 0.2$ by choosing $h = 0.1$.

22. Given that $\frac{dy}{dx} = \log(x + y)$ with the initial condition $y = 1$ at $x = 0$. Use Euler's modified method to find 'y' at 0.2 and 0.5.

23. Solve $\frac{dy}{dx} = \frac{1}{x + y}$, $y(0) = 1$ for $x = 0.5(0.5)\,1$ using Runge-Kutta fourth order method.

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MATHEMATICS – XIV

Paper 6.3 – Graph Theory – II

(CBCS – New)

Time : 3 Hours Max. Marks : 70

Instructions : *Answer all Sections.*

SECTION – A

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

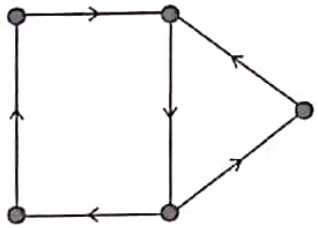
1. Draw line graph of K_3 and define line graph.

2. Draw total graph of P_3.

3. Define r-regular digraph and draw 1-regular digraph.

4. Find out degree and indegree of the graph G given below :

G :



5. If G is a 4 degree connected planar graph having 16 edges, find the number of regions.

6. Show that $K_{2,4}$ is planar.

7. Define proper coloring of graph and give two different proper coloring of the graph.

G given below

G :

SECTION – B

Answer **any five** of the following : **(5 × 6 = 30)**

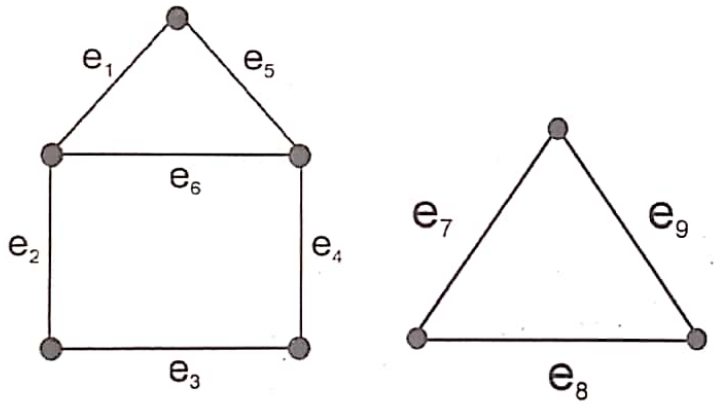
8. Find the incidence matrix of K_4.

9. Define incidence matrix and find the graph whose incidence matrix is

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

10. Define cycle matrix and find the cycle matrix of G shown below :

G :



11. If G is a (p, q) graph whose vertices have degree d_i then show that $L(G)$ has q vertices and q_L edges where $q_L = \frac{1}{2}\sum_{i=1}^{p} d_i^2 - q$.

12. If G is a connected planar graph with p vertices and q edges, if G is triangle free then show that

(a) $q \geq 2r$ (b) $q \leq 2p-4$.

13. Suppose we wish to supply three houses each with three utilities electricity water and gas. Is it possible to connect each utility with each of three houses without crossing of utility lines?

14. Let G be connected planar graph with p vertices, q edges and r-regions (faces) then prove that $q - p + 2 = r$.

SECTION – C

Answer **any five** of the following : **(5 × 6 = 30)**

15. Show that a graph with atleast one edge is bipartite if and only if it is 2-chromatic.

16. Define chromatic number. Find chromatic number of cycle C_p with $p \geq 3$ and hence write the value of $\chi(C_4)$.

17. Prove that every connected simple planar graph G is 6-colorable.

18. Define Digraph. Let D be a digraph of order p and size q with $V(D) = \{V_1, V_2, \cdots, V_p\}$ then prove that

$$\sum_{i=1}^{p} od\, V_i = \sum_{i=1}^{p} id\, V_i = q.$$

19. Show that a graph with p vertices is a complete graph if and only if its chromatic polynomial is $f(K_p, \lambda) = \lambda(\lambda-1)(\lambda-2)\cdots(\lambda-p+1)$.

20. If $\Delta(G)$ is the maximum of the degrees of the vertices of a graph G, then prove that $\chi(G) \leq 1 + \Delta(G)$.

21. Define chromatic polynomial and with usual notation show that

$$f(G, \lambda) = C_1 \frac{\lambda}{1!} + C_2 \frac{\lambda(\lambda-1)}{2!} + \cdots + C_p \frac{\lambda(\lambda-1)\cdots(\lambda-p+1)}{p!}$$

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MATHEMATICS

Paper XII (6.1) – Trigonometry and Complex Analysis

(Very Old)

Time : 3 Hours Max. Marks : 80

Instructions : *Answer* ***all*** *Sections.*

SECTION – A

Answer **any ten** of the following : **(10 × 2 = 20)**

1. Show that : $\operatorname{cosec}(ix) = -i \operatorname{cosec} h\ x$.

2. Prove that : $\sinh 3x = 3\sinh x + 4\sinh^3 x$.

3. Prove that : $\cos(x-y) = \cosh x \cosh y - \sinh x \sinh y$.

4. Find the general value of $\sqrt{3}+i$.

5. Find whether $f(z) = \sin z$ is differentiable at $z_0 = i$.

6. Find the fixed points of the transformation $W = 3z - 4/z$.

7. Show that $u = x^2 - y^2 + x + 1$ is harmonic.

8. Evaluate : $\int_C \frac{1}{z(z-1)}\,dz$ where C is $|z| = 3$.

9. Evaluate : $\int_C (\bar{z})^2\,dz$ around the circle $|z-1| = 1$.

10. Show that $\arg\left(\frac{\bar{z}}{z}\right) = \frac{\pi}{2}$ represents a Line through the origin.

11. Evaluate : $\lim_{z \to i}(z^3 - 2z^2 + 5z)$

12. Evaluate : $\int_0^{3+i} z^2\,dz$ along the line $3y = x$.

SECTION – B

Answer **any five** of the following : **(5 × 6 = 30)**

13. Show that $\frac{\cos 7\theta}{\cos \theta} = 64\cos^6\theta - 112\cos^4\theta + 56\cos^2\theta - 7$.

14. Find the real and imaginary parts of $\tan x + iy$.

15. Prove the necessary condition for a function $f(z)$ to be analytic and establish them.

16. Prove that $f(z) = \cosh z$ is analytic and $f'(z) = \sinh z$.

17. State and prove Cauchy's integral formula.

18. Show that the transformation $w = 1/z$ transform a circle to a circle 'OR' to a straight line.

19. Construct the Analytic function $f(z) = u + iv$ given $u + v = e^x(\sin y + \cos y)$.

SECTION – C

Answer **any five** of the following : **(5 × 6 = 30)**

20. If $u = \frac{\sin 2x}{\cosh 2y + \cos 2x}$ then find the corresponding analytic function $f(z)$.

21. If $u - v = (x - y)(x^2 + 4xy + y^2)$ find $f(z) = u + iv$ is an analytic function of z, Find $f(z)$ interms of z.

22. If a function $f(z) = u + iv$ is analytic in a domain D and $|f(z)|$ is constant, show that $f(z)$ is also a constant in D.

23. Evaluate $\int_0^{a+i} (x^2 - iy)\,dz$ along the curve $y = x$ and $y = x^2$.

24. Evaluate $\int_C \bar{z}\, dz$ where C is given by two lines joining $z = 0$, $z = 2i$ then $z = 2i$ to $z = 4 + 2i$.

25. If $f(z) = u + iv$ is analytic and ϕ is any differentiable function of x and y, show that

$$\left(\frac{\partial \phi}{\partial x}\right)^2 + \left(\frac{\partial \phi}{\partial y}\right)^2 = \left[\left(\frac{\partial \phi}{\partial u}\right)^2 + \left(\frac{\partial \phi}{\partial v}\right)^2\right] \left|\frac{1}{f(z)}\right|^2$$

26. Evaluate $\int_C (x^2 - iy^2)dz$ along $y = 2x^2$ from (1, 2) to (2, 8).
