NP – 272

V Semester B.A./B.Sc. Examination, February/March 2024
(NEP) (Freshers)
COMPUTER SCIENCE
Database Management System

Time : 2½ Hours Max. Marks : 60

Instruction : *Answer* ***all*** *Parts.*

PART – A

Answer **any four** questions. **Each** question carries **two** marks. **(4×2=8)**

1. Define Database. Mention two applications of it.
2. What is data independence ? Mention two types of data independence.
3. Define weak entity and strong entity.
4. What is schema and sub-schema ?
5. Name any two set operations in relational algebra.
6. Mention any two responsibilities of DBA.

PART – B

Answer **any four** questions. **Each** question carries **five** marks. **(4×5=20)**

7. Explain different types of attributes with respect to entity relationship model.
8. Explain three schema architecture of DBMS with diagram.
9. Explain Create, Alter, Drop, Insert and Delete command with example.
10. Write a note on selection and projection operators with respect to relational algebra.
11. What is transaction ? Explain ACID properties of a transaction.
12. Explain the functions of secondary storage devices.

P.T.O.

PART – C

Answer **any four** questions. **Each** question carries **eight** marks. **(4×8=32)**

13. Explain the advantages of DBMS over traditional file systems. **8**

14. Write a detail note on different types of users in database. **8**

15. a) What is normalization ? **2**
    b) Explain functional and transitive dependency with example. **6**

16. a) Explain two phase locking technique. **4**
    b) Write a note on database recovery techniques. **4**

17. Draw an ER diagram for library management system. **8**

18. a) Write a note on inner join and outer join operations. **6**
    b) What is concurrency control ? **2**

NP – 222

V Semester B.Sc. Examination, February/March 2024
(NEP) (Freshers)
MATHEMATICS (Major)
Paper – 5.2 : Vector Calculus and Analytical Geometry

Time : 2½ Hours Max. Marks : 60

Instruction : *Answer **all** questions.*

PART – A

I. Answer **any ten** questions. **(10×2=20)**

1) If $\vec{r} = t\hat{i} - t^2\hat{j} + \sin t\hat{k}$, find $\left(\frac{dr}{dt} \times \frac{d^2r}{dt^2}\right)$ at $t = 0$.

2) If $\phi(x, y, z) = 3x^2 + 2y - 3z$, find $|\nabla\phi|$ at $(2, 1, -3)$.

3) Find the unit normal vector to the surface $yz + zx + xy = c$ at $(-1, 2, 3)$.

4) State Gauss-Divergence theorem.

5) Evaluate by Stoke's theorem, $\oint_c yzdx + zxdy + xydz$ where 'c' is the curve, $x^2 + y^2 = 1$, $z = y^2$.

6) Show that area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is πab by using Green's theorem.

7) Find the equation of the line passing through the points (2, 4, 8) and (–1, 6, 3).

8) Find the angle between the planes $3x - 6y + 2z + 5 = 0$ and $4x - 12y + 3z - 3 = 0$.

9) Find the centre and radius of the sphere $x^2 + y^2 + z^2 - 6x - 8y - 2z - 1 = 0$.

10) Find the equation of a cone whose vertex is origin, semivertical angle is 60° and axis along z-axis.

11) Write the general second order degree equation of conicoid.

12) Write the condition for a plane to touch the conicoid at a point (f, g, h).

P.T.O.

PART – B

II. Answer **any two** questions. **(2×5=10)**

13) Find the directional derivative of $\phi(x, y, z) = x^2 - 2y^2 + 4z^2$ at the point $(1, 1, -1)$ in the direction of $2\hat{i}+\hat{j}-\hat{k}$.

14) Find the equation of the tangent plane and the normal line to the surface $x^3 + y^3 + 3xyz = 3$ at the point $(1, 2, -1)$.

15) If the vector $\vec{F} = (ax+3y+4z)\hat{i}+(x-2y+3z)\hat{j}+(3x+2y-z)\hat{k}$ is solenoidal, find 'a'.

16) For any scalar field ϕ and any vector field $\vec{F}$, prove that curl $(\phi \vec{F}) = \phi$ curl $\vec{F}$ + (grad ϕ) $\times \vec{F}$.

PART – C

III. Answer **any two** questions. **(2×5=10)**

17) State and prove Green's theorem.

18) Verify Green's theorem in the plane $\oint_c (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where 'c' is the boundary of the rectangular area enclosed by the lines $x = 0$, $x = 1$, $y = 0$ and $y = 2$.

19) Evaluate the Gauss-Divergence theorem for $\vec{F} = 4x\hat{i}-2y^2\hat{j}+z^2\hat{k}$ taken over the region bounded by $x^2 + y^2 = 1$, $z = 0$ and $z = 3$.

20) Evaluate $\oint_c \vec{F}\cdot d\vec{r}$ using Stoke's theorem for the function $\vec{F} = x\hat{i}+z^2\hat{j}+y^2\hat{k}$ over the plane surface $x + y + z = 1$ that lies in the first octant.

PART – D

IV. Answer **any two** questions. **(2×5=10)**

21) Find the equation of the plane which bisects the angle between the planes $3x - 4y + z - 3 = 0$ and $5x + 3y - 4z - 9 = 0$.

22) Find the reflection of the point $(2, -1, 0)$ in the line $\frac{x-2}{2} = \frac{y-1}{1} = \frac{z-3}{1}$

23) Find the angle between the line $\frac{x-3}{2} = \frac{y+1}{-1} = \frac{z+4}{3}$ and the plane $2x + 3y - z - 4 = 0$.

24) Find the equation of the sphere which passes through the points $(7, 9, 1)$, $(-2, -3, 2)$, $(1, 5, 5)$ and $(-6, 2, 5)$.

PART – E

V. Answer **any two** questions. **(2×5=10)**

25) Derive the equation of the right circular cone in its standard form $x^2 + y^2 = z^2\tan^2\alpha$.

26) Find the equation of right circular cone whose axis is $\frac{x-1}{-1} = \frac{y-2}{3} = \frac{z-3}{3}$ and generator is $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$.

27) Explain the equation of hyperboloid of one sheet with properties.

28) Show that the plane $x + 2y + 3z = 2$ touches the conicoid $x^2 - 2y^2 + 3z^2 = 2$.

NP – 221

V Semester B.Sc. Degree Examination, February/March 2024
(NEP) (Freshers)
MATHEMATICS (Major)
Paper – 5.1 : Real Analysis – II and Complex Analysis

Time : 2½ Hours Max. Marks : 60

Instruction : *Answer **all** questions.*

PART – A

I. Answer **any ten** questions. **(10×2=20)**

1) Define Riemann integrability.

2) Show that $\lim_{n\to\infty}\left[\frac{1}{n}+\frac{n^2}{(n+1)^3}+\frac{n^2}{(n+2)^3}+\frac{n^2}{(n+3)^3}+\ldots\ldots\ldots+\frac{1}{8^n}\right]=\frac{3}{8}$.

3) Find the common Refinement of $P_1=\left\{0,\frac{1}{3},\frac{2}{3},1\right\}$ and $P_2=\left\{0,\frac{1}{2},1\right\}$.

4) Examine the convergence of $\int_0^1 \frac{1}{x^2}\,dx$.

5) Prove that $\Gamma(n+1)=n\Gamma(n)$.

6) Evaluate $\beta\left(\frac{9}{2},\frac{7}{2}\right)$.

7) Evaluate $\lim_{z\to 1+i}\left(z^2-5z+10\right)$.

8) Show that f(z) = xy + iy is continuous but is not analytic.

9) Define Harmonic function.

10) State Cauchy's Inequality.

11) Evaluate $\int_c \frac{z}{z-2}\,dz$, where c is a circle |z| = 1.

12) Evaluate $\int_c \frac{e^z}{z}dz$, where c is the unit circle with centre at the origin.

PART – B

II. Answer **any two** questions. **(2×5=10)**

13) Calculate the upper and lower Riemann sum for the function f(x) = x + 1 under the partition $P=\left\{0,\frac{1}{3},\frac{2}{3},1\right\}$.

14) Show that f(x) = x is Riemann integrable in [0,1].

P.T.O.

15) If f(x) is a real valued function defined and bounded on [a, b] then show that $m(a-b) \le L(p, f) \le U(p, f) \le M(a-b)$.

16) If f is Riemann integrable over [a, b]. Show that |f| is also Riemann integrable over [a, b] and $\left|\int_a^b f(x)dx\right| \le \int_a^b |f(x)|\,dx$.

PART – C

III. Answer **any two** questions. **(2×5=10)**

17) Examine the convergence of $\int_0^1 \frac{1}{(2x-x^2)}\,dx$.

18) Prove that $\beta(m,n) = \frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$, where m, n > 0.

19) Prove that $\int_0^{\pi/2} \tan\theta\, d\theta = \frac{\pi}{\sqrt{2}}$.

20) Evaluate $\int_0^2 x(8-x^3)^{\frac{1}{3}}\,dx$.

PART – D

IV. Answer **any two** questions. **(2×5=10)**

21) Prove that f(z) = sinz is analytic and hence f'(z) = cosz.

22) Obtain the necessary condition for the function f(z) = u(x, y) + i v(x, y) to be analytic.

23) Prove that $u = x^3 - 3xy^2$ is harmonic function and find its harmonic conjugate.

24) If $u = e^x(x\cos y - y\sin y)$, find the analytic function f(z) = u + iv.

PART – E

V. Answer **any two** questions. **(2×5=10)**

25) Evaluate $\int \left(\bar{z}\right)^2 dz$ around the circle

i) |z| = 1 ii) |z – 1| = 1.

26) State and prove Cauchy's integral formula.

27) Discuss the transformation $\omega = \frac{1}{z}$.

28) Prove that bilinear transformation preserves cross ratio of four points.

NP – 207

V Semester B.Sc. Examination, February/March 2024
(NEP) (Freshers)
CHEMISTRY
DSC-6 : Inorganic and Biological Chemistry – III

Time : 2½ Hours Max. Marks : 60

Instructions : *i) Question paper has **3** Parts. Answer **all** the Parts.*
*ii) Draw diagrams and chemical equation **wherever** necessary.*

PART – A

Answer **any four** questions. **Each** question carries **two** marks. **(2×4=8)**

1. Write the IUPAC names of the following :
   i) $[Pt(NH_3)_2Cl_2]$
   ii) $[Cr(CO)_6]$.
2. What are propellants ? Give an example.
3. Mention the role of gypsum in setting of cement.
4. Mention the contribution of the following scientists for the development of biochemistry :
   i) Watson and Crick
   ii) Knoop.
5. What is iodine number ? What does high iodine number of an oil indicates ?
6. What is active site of an enzyme ?

PART – B

Answer **any four** questions. **Each** question carries **five** marks. **(5×4=20)**

7. a) What are ligands ? How are they classified ? Give an example for each.
   b) What are organometallic complexes ? **(3+2)**

P.T.O.

8. a) Write a note on Monsanto acetic acid process and the role of cyanocobalamine in living systems.

   b) What are hydrate isomers ? Give an example. **(3+2)**

9. a) Write any four characteristics of a good fuel.

   b) What is the use of sawdust and common salt in the manufacture of SiC ? **(3+2)**

10. a) What is a paint ? Explain the role of following in paint :

   i) Linseed oil

   ii) Turpentine.

   b) Write a note on annealing of glass. **(3+2)**

11. a) Give the structure of isomaltose. How is it obtained from starch ?

   b) What is protein denaturation ? Mention any two reagents which causes denaturation. **(3+2)**

12. a) Name the different types of RNA and their role in biological systems.

   b) Give the differences between nucleoside and nucleotide. **(3+2)**

PART – C

Answer **any four** questions. **Each** question carries **8** marks. **(8×4=32)**

13. a) Explain the splitting of d-orbitals in octahedral complex.

   b) Calculate the EAN of $Mn_2(CO)_{10}$ according to 18 electron – rule and write its structure.

   c) Mention any two limitations of VBT. **(4+2+2)**

14. a) Describe the manufacture of portland cement by wet process.

   b) What are refractories ? Give the characteristics of a good refractory. **(4+4)**

15. a) Write the partial structure of glycogen. Give its biological importance. How does it differ from starch ?

    b) What are amino sugars ? Write the structure of N-acetylglucoseamine. **(4+4)**

16. a) Describe the α-helical structure of proteins.

    b) What are phosphoglycerides ? Mention their biological importance. **(4+4)**

17. a) Explain :

        i) Lock and Key theory of enzyme catalysis.

        ii) Effect of temperature on enzyme catalysis.

    b) Explain the different types of specificity exhibited by enzymes with examples. **(4+4)**

18. a) What are harmones ? What is biological action of oxytocin ?

    b) Explain the principle behind electrophoresis. Give its applications. **(4+4)**

NP – 288

V Semester B.Sc. Examination, February/March 2024
(NEP) (Freshers)
ELECTRONICS (Paper – VI)
DSCEL502 : Embedded Controllers

Time : 2½ Hours Max. Marks : 60

Instruction : *Answer* ***any four*** *questions from* ***each*** *Part.*

PART – A

Answer **any four** questions. **(4×2=8)**

1. What do you mean by an embedded system ?
2. Define :
   a) Assembler b) Compiler
3. What do you mean by interrupt ?
4. What do you mean by stack ?
5. Compare any two features of 8051 and PIC.
6. Mention two SFRs in PIC microcontroller.

PART – B

Answer **any four** questions. **(4×5=20)**

7. Write an assembly language program to add two 8 bit numbers.
8. Write an assembly language program to verify the given number is prime or not.
9. Write a C program to generate a square wave.
10. Explain the bit pattern of IE register.

P.T.O.

11. What will be the content of TMOD register to operate timer 1 in mode 0 ?

12. Explain the memory organization of PIC microcontroller.

PART – C

Answer **any four** questions. **(4×8=32)**

13. Explain the pin diagram of 8051 microcontroller.

14. Explain the addressing modes of 8051 microcontroller.

15. Explain the instruction sets of 8051 microcontroller.

16. Explain the features of PIC 18F458.

17. Explain with a diagram to interface ADC with a PIC microcontroller.

18. Explain with a diagram to interface stepper motor with a 8051 microcontroller.

NP – 287

V Semester B.Sc. Examination, February/March 2024
(NEP Scheme) (Freshers)
ELECTRONICS (Paper – V)
DSCEL 501 : Communication – II

Time : 2½ Hours Max. Marks : 60

Instruction : *Answer **any four** questions from **each** Part.*

PART – A

Answer **any four** questions : **(4×2=8)**

1. Give any two applications of Microwaves.
2. What is a waveguide ? Why are waveguides preferred over T-line for transmitting microwave signals ?
3. What is an equalizer ?
4. Expand :
   a) IMIE
   b) ARFCN in cellular communication.
5. What is meant by call hand-off in cellular communication ?
6. Mention the layers of TCP/IP protocol.

PART – B

Answer **any four** questions : **(4×5=20)**

7. A typical n-type GaAs Gunn diode has the following parameters :
   Threshold field E_{th} = 2800 V/cm, Applied field E = 3200 V/cm, L = 10 μm, Doping concentration $n_0 = 2 \times 10^{14}$ cm^{-3}, Operating frequency f = 10 GHz.
   Calculate :
   a) Electron drift mobility
   b) Negative electron mobility.

P.T.O.

8. An IMPATT diode operates at 150 V delivering 1A of current at 8% efficiency. Calculate the output power and duty cycle, if the device is operated in pulsed mode at 20 GHz with a pulse width of 0.5 pico-secs.

9. A system has a bandwidth of 6 KHz and a signal to noise ratio is 20 dB at the input to the receiver. Calculate :
   a) Information capacity
   b) The capacity of the channel, if its bandwidth is doubled, while the transmitted signal power remains constant.

10. Draw the QPSK waveform for a binary sequence 1001111000.

11. In the standard Ethernet with the transmission rate of 10 Mbps, length of the medium is 2500 m and the size of the frame is 512 bits. The propagation speed of a signal in a cable is normally 2×10^8 m/s. Find.
   i) Propagation delay
   ii) Transmission delay
   iii) Number of frames that can fit in the medium.

12. Draw different types of network topologies.

PART – C

Answer **any four** questions : **(4×8=32)**

13. a) Explain the characteristics of waveguide in detail.
   b) What are directional couplers ? Define coupling factor and directivity in directional couplers. **(4+4)**

14. a) Explain the construction and working of klystron with a neat diagram.
   b) Explain the basic principle of a circulator. **(5+3)**

8. Calculate the longest and shortest wavelength of Balmer series of hydrogen atom.

   Given : Rydberg's constant = $1.097 \times 10^7\ m^{-1}$.

9. In Stern and Gerlach experiment silver atoms travel a distance of 0.1 m in a non-homogenous magnetic field of gradient of 50 Tm^{-1}. Calculate the displacement of the atoms along the field direction.

   Given : Velocity of silver atoms = 450 ms^{-1}

   Mass of silver atoms = 1.79×10^{-25} kg

   Bohr Magneton = $9.23 \times 10^{-24}\ JT^{-1}$

10. The rotational constant for a HF molecule is found to be 20.2 cm^{-1}. Calculate the moment of inertia of the molecule and the inter atomic distance.

    Given : Reduced mass of HF molecule = 1.58×10^{-27} kg

    $h = 6.625 \times 10^{-34}$ Js

    $c = 3 \times 10^8\ ms^{-1}$

11. A radiation of wavelength 546.1 nm excites a substance to emit Raman line of wavelength 538.2 nm. Calculate the Raman frequency and the wavelength of the corresponding Stoke's line.

    Given $c = 3 \times 10^8$ m/s

12. A He-Ne laser of wavelength 6328 Å is emitting a beam of average power 4.5 mW. Calculate the number of photons emitted per second by the laser.

    Given : $h = 6.625 \times 10^{-34}$ Js

    $c = 3 \times 10^8$ m/s

PART – C

Answer **any four** questions. **Each** question carries **8** marks.

13. a) What are critical potentials ?

    b) With a neat diagram explain Franck and Hertz experiment to determine the critical potentials of mercury. **(2+6)**

NP – 545

Fifth Semester B.Sc. Examination, February/March 2024
(NEP) (Freshers)
PHYSICS
DSC 6 : Elements of Atomic, Molecular and Laser Physics

Time : 2½ Hours Max. Marks : 60

Instructions : *i) Answer **any four** questions from **each** Part.*

*ii) Use of non-programmable scientific calculators is **permitted**.*

PART – A

Answer **any four** questions. **Each** question carries **2** marks.

1. State any two assumptions made by Rutherford in his alpha scattering experiment.
2. The path of an electron in a orbit is a "rosetle" according to Sommer Feld's model. Explain.
3. What is Gyro magnetic ratio ?
4. Are the energy levels in a purely rotational spectrum equally spaced ? Explain.
5. What is Fluorescence ?
6. Mention any two differences between ordinary light and laser light.

PART – B

Answer **any four** questions. **Each** question carries **5** marks.

7. How much energy is required to raise the hydrogen atom from ground state to the excited state n = 4 ? What is the wavelength of the emitted spectral line when the atom returns to the ground state ?

   Given $h = 6.625 \times 10^{-34}$ Js

   $c = 3 \times 10^{8}$ m/s

15. a) Draw the block diagram of a cellular phone hand set and explain the function of each block.

    b) What are the advantages of Digital communication over Analog communication ? **(4+4)**

16. a) Define baud rate and bit rate with an example.

    b) Define ASK and FSK. Sketch their waveforms. **(3+5)**

17. a) What is MODEM ? How are MODEM's classified ?

    b) Compare GSM and CDMA with respect to cellular communication system. **(4+4)**

18. a) What is network topology ?

    b) What are the characteristics of wireless LAN ? **(3+5)**

19. a) Write a note on bluetooth technology.

    b) Draw a 7-layer OSI model and explain. **(3+5)**

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14. a) Explain how vector atom model accounts for the fine structure of sodium D lines.

    b) Derive an expression for Larmor's frequency. **(4+4)**

15 a) What is Zeeman effect ?

    b) With a neat diagram describe the experimental set-up to study Zeeman's effect. **(2+6)**

16. Give the theory of vibrating molecule as a simple harmonic oscillator. **8**

17. Derive Einstein's coefficient in a laser. **8**

18. Describe with energy level diagrams the construction and working of a Ruby laser. **8**

NP – 544

V Semester B.Sc. Examination, February/March 2024
(NEP) (Freshers)
PHYSICS
DSC – 5 : Classical Mechanics and Quantum Mechanics – I

Time : 2½ Hours Max. Marks : 60

Instructions : *1) Answer **any four** questions from **each** Part.*
*2) Use of non-programmable calculator **allowed**.*

PART – A

Answer **any four** of the following. **(4×2=8)**

1. Give two important significances of Newton's first law.
2. Explain why an inertial frame can not exist ?
3. Give the postulates of special theory of relativity.
4. Why alkali metals are suitable for photoelectric effect ?
5. For a particle in a one dimensional box, how many nodes and antinodes are possible for a given value of n ?
6. What is quantum mechanical tunneling ?

PART – B

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

7. A body of mass 30 kg initially at rest is pulled by a force of 10N through a distance of 6m. Calculate the speed of the body neglecting frictional force.
8. Two bodies each of mass 1kg are moving with a velocity of 0.8C in opposite directions. Find their relative velocity. ($C = 3 \times 10^8\ ms^{-1}$)
9. Calculate the percentage contraction in the length of a rod moving parallel to its length with a speed of 0.8C with respect to a stationary observer. ($C = 3 \times 10^8\ ms^{-1}$)
10. Calculate the compton shift if the wavelength of incident X-ray is 1.10Å. Also calculate the wavelength of radiation scattered at 90°.
($m = 9.1\times10^{-31}$ kg, $h = 6.625 \times 10^{-34}$ Js, $c = 3 \times 10^8\ ms^{-1}$)

P.T.O.

11. Calculate the quantum numbers and the state of the electron inside a cubical box of side 0.1 nm with momentum 9.957×10^{-24} NS. ($h = 6.625 \times 10^{-34}$ JS)

12. The period of a harmonic oscillator in the ground state is 1.2×10^{-14} S. Find its zero point energy in eV. Also calculate the spacing between 2nd and 3rd energy levels.

PART – C

Answer **any four** of the following. (4×8=32)

13. a) State the Newton's laws of motion.
    b) Explain the concept of virtual work and hence arrive at D'Alembert's principle. (4+4)

14. a) Give the general form of Lagrange's equation. Explain the terms.
    b) Derive an expression for the period of a simple pendulum using Lagrange's equation. (2+6)

15. Describe with a diagram Michelson-Morley experiment. Explain its result. 8

16. a) State Heisenberg's uncertainty principle.
    b) Prove the uncertainty principle using Gamma ray microscope. (2+6)

17 a) What is group velocity ?
    b) Obtain an expression for group velocity based on the principle of superposition. (2+6)

18. Derive the expressions for energy and normalised wave function for a particle in a one dimensional box of infinite height. 8