

BT-1/D-23

41037

CHEMISTRY

Paper-BS-101A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Explain the Crystal Field Theory for octahedral and square planer complexes. Define the Crystal Field splitting energy and Crystal field stabilization energy. Explain the magnetic behavior of an octahedral complex taking suitable example on the basis of CFT using energy level diagram. 10
- (b) Explain the pi-molecular orbitals and the electronic distribution among them for Buta-1, 3-diene. 5
2. (a) Define the Aromaticity of Organic compounds. Describe different types of Aromatic compounds with example. 5
- (b) Define doping in semiconductors. Also describe various types of semiconductors. What is the effect of doping on their band structures? 5

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- (c) Compare the bond length in N_2 , N_2^+ and N_2^- on the basis of molecular orbital energy level diagram. 5

UNIT-II

3. (a) Define electromagnetic radiations. Mention the different regions of electromagnetic spectrum used in various spectroscopy techniques. 5
- (b) Differentiate between Fluorescence and phosphorescence with the help of Jablonski diagram. 5
- (c) Explain various stretching and bending vibration involved in IR spectroscopy. 5
4. Write notes on the following :
- (a) UV-visible spectroscopy. 5
- (b) Nuclear Magnetic resonance Spectroscopy. 5
- (c) MRI. 5

UNIT-III

5. (a) Derive Nernst equation and give its applications. 3
- (b) Define the term entropy and give its unit. What is its significance? Find out the entropy change for an ideal gas. 6
- (c) Write basic aspects of VSEPR theory. Also explain bond angle in NH_3 and NF_3 on basis of VSEPR theory. 6

6. (a) Write a note on Hard/Soft acid and base concept. Also give its significance. 5
- (b) Define the terms- electron affinity, Ionization energy and Electronegativity. Also explain the significance of electronegativity and various factors effecting these periodic properties. 10

UNIT-IV

7. Differentiate between (with proper examples) :
- (a) E1 and E2 elimination mechanism. 5
- (b) S_N1 and S_N2 mechanism of substitution reaction. 5
- (c) Electrophilic substitution and Free radical substitution. 5
8. (a) Define Isomerism. Explain different types of optical isomers with suitable examples. Explain CIP rules for assigning absolute configuration to organic compounds. 10
- (b) Differentiate ring opening and cyclisation process in organic compounds with suitable 5

... and while a note on the ... also give ...

DIFFERENTIAL

- (a) Differentiate between ...
- (b) ...
- (c) ...
- (d) ...
- (e) ...

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41038

**PROGRAMMING FOR PROBLEM
SOLVING**

Paper-ES-105A

Time Allowed : 3 Hours] [Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Solve the following:
 - (i) $(126)_8 - (376)_8$
 - (ii) $(FBD7.CD)_{16} + (98FE.5C)_{16}$
 - (iii) $(59FD.45EA)_{16} = (?)_{10}$ 9
- (b) What do you understand by impact and non-impact printers? Explain the working principle of laser printer. 6
2. (a) Solve the following:
 - (i) $(6735.547)_8 = (?)_{10}$ 4
 - (ii) $(478)_{10} - (4389)_{10}$ using 10' complement with proper steps. 5

- (b) What do you understand by flowchart? Draw a flowchart to find the roots of a quadratic equation. 6

UNIT-II

3. (a) Write a C program to find the largest out of three numbers using the Ternary Operator. 8
(b) Write a C program to Generate Multiplication Table. 7
4. (a) Write a C program to calculate the following series without pow () function :

$$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots - \frac{x^n}{n!} \quad 7$$

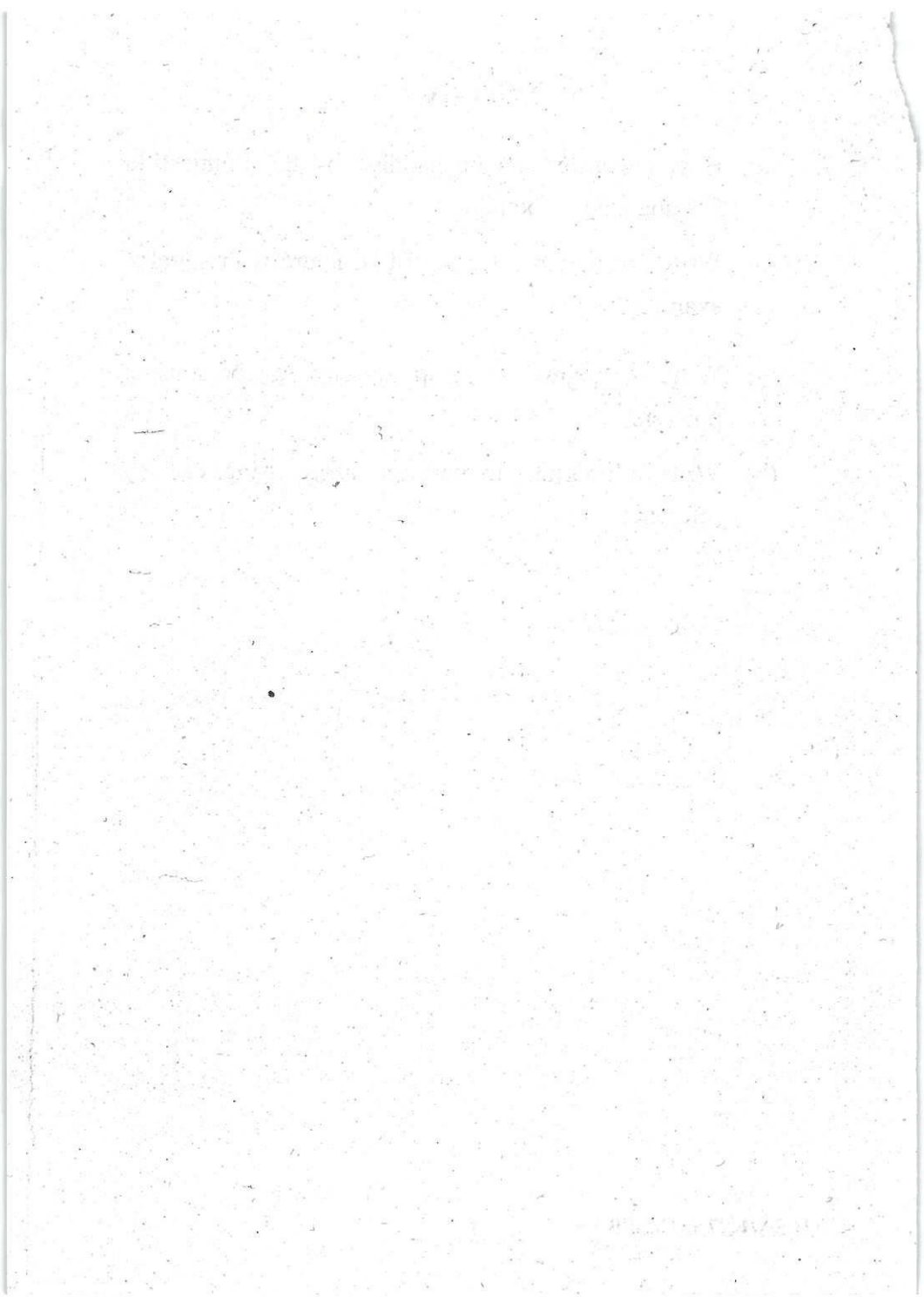
- (b) Describe the loops statements with examples. 8

UNIT-III

5. (a) Write a program in C to multiply two matrices. 8
(b) Write a program to check whether sting is palindrome or not without using string function. 7
6. (a) Write a program in C for concatenation of two strings without using strcat (). 7
(b) What is Recursion ? Write a program to find the factorial of a number using recursion. 8

UNIT-IV

7. (a) How the array can be handled by the Pointers in C Language ? Explain. 8
- (b) Write a program for array of structure with suitable example. 7
8. (a) Write a program to swap the two numbers using pointers. 8
- (b) Write a program to sort the array using call by reference. 7



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ENGLISH

Paper-HM-101A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt any **five** questions in all. All questions carry equal marks.

1. Make **two** words using the following suffixes and prefixes: 15

- | | |
|-------------------|--------------------|
| (i)ic, | (ii)al, |
| (iii)ee, | (iv)ward, |
| (v)logy, | (vi) homo....., |
| (vii) socio....., | (viii) hyper....., |
| (ix) bene....., | (x) ab..... , |
| (xi) an..... | (xii) ante..... |
| (xiii)ity | (xiv)fy |
| (xv) para... .. | |

2. Make sentences out of the following Phrases given : 15

- | | |
|---------------|--------------------|
| (i) Knock out | (ii) Fait accompli |
|---------------|--------------------|

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- | | |
|---------------------|------------------------|
| (iii) Couch potato | (iv) Faux pas |
| (v) Go Dutch | (vi) Fender-bender |
| (vii) hang out | (viii) Out of the blue |
| (ix) modus operandi | (x) Double minded |
| (xi) Pie in the sky | (xii) Herculean Task |
| (xiii) De Facto | (xiv) Status Quo |
| (xv) Per se. | |

3. Correct the following sentences : 15

- (i) Every student like the teacher.
- (ii) I must to call him immediately.
- (iii) His family members are coming by this train.
- (iv) Neither he nor I is going to do the work.
- (v) I enjoyed from the movie.
- (vi) Jean Paul Sartre is French philosopher who wrote the book *Being and Nothingness*.
- (vii) When I entered the bedroom, I saw a snake crawling on the ground.
- (viii) My sister and myself are pleased to accept your invitation.
- (ix) In three weeks time we are going to complete the work.

- (x) He is twenty years old, isn't it?
- (xi) She can to drive.
- (xii) There are numerous complains; late coming is one among them.
- (xiii) The ongoing battle of words between Radha, Shyam and their father hampers the peace of the house.
- (xiv) Will you kindly open this knot?
- (xv) You speak English good.

4. Punctuate the following sentences : 15

- (i) Hey close the door
- (ii) May I come in
- (iii) Understand you are not allowed in here
- (iv) Go and place it on the table
- (v) Sorry said Leela after a long pause
- (vi) Claim the prize
- (vii) Stop it
- (viii) They are to send letters to the leaders of charitable organisation.
- (ix) Engineers require an advanced knowledge of algebra trigonometry and geometry

- (x) We have paid our dues we expect all the privileges listed in the contract
- (xi) I need the following articles a glass a cup a jug and a napkin
- (xii) Oh I missed by one mark said Rehan
- (xiii) Great we are going out for shopping said Anuradha
- (xiv) I want you to see the dress said Ramesh excitedly
- (xv) bravo you have won the match

5. Write an essay on any **one** of the following topics : 15

- (i) Racial Discrimination
- (ii) Global Warming
- (iii) Cyber Culture
- (iv) Digital India.

6. Write a precise of the following passage and suggest a suitable title: 15

Democracy would have been impossible without the printing press. The modern media of mass communication are another fruitful source of education are being spent on manufacturing weapons of mass annihilation and space exploration, the affluent nations

are not prepared to help developing nations on a scale which would make a significant impact on their lives. Many civilizations in the past perished because the people recklessly exploited natural resources, exhausted the soil and turned the land into a desert. Impelled by the profit-motive, nations are still recklessly exploiting world resources without giving any serious thought to what would happen a few hundred years hence. When we know that man has to live on this planet for millions of years, this policy of exploiting natural resources and not judiciously conserving them is, to put it mildly, extremely short-sighted. The same short-sightedness is being displayed over population growth. Science has rendered great service to humanity by finding a cure for most diseases, by preventing the outbreak of epidemics which formerly used to kill millions of persons, and by curtailing the death rate in other ways. But unless men learn to curtail the birth rate as well, we will, before long, be faced with a population explosion. Science has not proved that Malthus was wrong. It has only proved that for some time natural restraints on population in the form of wars, pestilences and famines can be held back. This planet can be made a decent place to live in only if man is wise. Science gives knowledge and power, but not necessarily wisdom.

7. Read the following passage and answer the questions that follow: 15

Philosophy of Education is a label applied to the study of the purpose, process, nature and ideals of education. It can be considered a branch of both philosophy and education. Education can be defined as the teaching and learning of specific skills, and the imparting of knowledge, judgment and wisdom, and is something broader than the societal institution of education we often speak of. Many educationalists consider it a weak and woolly field, too far removed from the practical applications of the real world to be useful. But philosophers dating back to Plato and the Ancient Greeks have given the area much thought and emphasis, and there is little doubt that their work has helped shape the practice of education over the millennia. Plato is the earliest important educational thinker, and education is an essential element in "The Republic" (his most important work on philosophy and political theory, written around 360 B.C.). In it, he advocates some rather extreme methods: removing children from their mothers' care and raising them as wards of the state, and differentiating children suitable to the various castes, the highest receiving the most education, so that they could act as guardians of the city and care for the less

able. He believed that education should be holistic, including facts, skills, physical discipline, music and art. Plato believed that talent and intelligence is not distributed genetically and thus is to be found in children born to all classes, although his proposed system of selective public education for an educated minority of the population does not really follow a democratic model. Aristotle considered human nature, habit and reason to be equally important forces to be cultivated in education, the ultimate aim of which should be to produce good and virtuous citizens. He proposed that teachers lead their students systematically, and that repetition be used as a key tool to develop good habits, unlike Socrates' emphasis on questioning his listeners to bring out their own ideas. He emphasized the balancing of the theoretical and practical aspects of subjects taught, among which he explicitly mentions reading, writing, mathematics, music, physical education, literature, history, and a wide range of sciences, as well as play, which he also considered important.

- (i) What is philosophy of education? 3
- (ii) What is the difference between the approaches of Socrates and Aristotle? 3
- (iii) Why do educationists consider philosophy a 'weak and woolly' field? 3

(iv) Were Plato's beliefs about Education Democratic? 3

(v) Suggest a suitable title to the above given passage. 3

8. What are the factors that contribute to clear, fluent and effective composition/writing? Discuss any three factors in detail. 15

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**MULTI-VARIABLE CALCULUS &
LINEAR ALGEBRA**

Paper-BS-135A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Prove that $\int_0^1 x^m (\log x)^n dx = \frac{(-1)^n \Gamma(n+1)}{(m+n)^{n+1}}$. 7½

(b) Find the surface area generated by revolving the Cubical parabola $x = y^3$ from $y = 0$ to $y = 2$ about the axis of y . 7½

2. Evaluate :

(a) $\lim_{x \rightarrow 0} \frac{xe^x - \log(1+x)}{x^2}$. 5

(b) $\lim_{x \rightarrow 0} \left[\frac{x \cos x - \log(1+x)}{x^2} \right]$. 5

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(c) $\lim_{x \rightarrow 0} \left[\frac{\tan x}{x} \right]^{1/x^2}$ 5

UNIT-II

3. (a) Test the convergence of the series : 7½

$$\frac{x}{1} + \frac{1}{2} \cdot \frac{x^3}{3} + \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{x^5}{5} + \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{5}{6} \cdot \frac{x^7}{7} + \dots \infty.$$

(b) Examine the convergence or divergence of the series : 7½

$$\sum_{n=1}^{\infty} (\sqrt{n^4+1} - \sqrt{n^4-1}).$$

4. (a) Find the Fourier series expansion of :

$$f(x) = \begin{cases} -1 & \text{for } -\pi < x < 0 \\ 0 & \text{for } x = 0 \\ 1 & \text{for } 0 < x < \pi. \end{cases} \quad \text{and deduce that}$$

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots - \infty = \frac{\pi}{4}. \quad 7\frac{1}{2}$$

(b) Find Fourier series of the function, 7½

$$f(x) = \begin{cases} 0 & \text{for } -5 < x < 0 \\ 3 & \text{for } 0 < x < 5. \end{cases}$$

UNIT-III

5. (a) Using Taylor's series, expand $\log(\sin x)$ in power of $(x - 2)$. 7½

- (b) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$, evaluate the value of : 7½

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}.$$

6. (a) If $u = x + 3y^2 - z^3$, $v = 4x^2 yz$, $w = 2z^2 - xy$, evaluate the value $\frac{\partial(u, v, w)}{\partial(x, y, z)}$ of at the point $(1, -2, 3)$. 7½

- (b) Find a point in the plane $x + 2y + 3z = 13$ nearest to the point $(1, 2, 1)$. 7½

UNIT-IV

7. (a) Use Gauss-Jordan method to find the inverse of the

Matrix $\begin{bmatrix} -1 & 2 & 2 \\ 2 & -1 & 2 \\ 2 & 2 & -1 \end{bmatrix}$. 7½

- (b) Investigate for what value of a and b the simultaneous equations;

$x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + az = b$, do not have a solution. 7½

8. (a) For the matrix, $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$, find the matrix

represented by :

$$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 4A + I,$$

using Cayley Hamilton Theorem. 7½

- (b) Find the eigen values and eigen vectors of the matrix : 7½

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}.$$

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ENGINEERING GRAPHICS & DESIGN

Paper-ES-109A

Time Allowed : 3 Hours] [Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks. Assume any missing data.

UNIT-I

1. (a) Point A is 20 mm above HP and in the 1st quadrant. Its shortest distances from the XY line is 40 mm. Draw the projections determine its distance from VP. 7
- (b) Draw an involute of a circle of 40 mm diameter. Also, draw a normal and a tangent to it at a point 100 mm from the centre of the circle. 8
2. Show by means of drawing that when the diameter of the directing circle is twice that of the generating circle, the hypocycloid is a straight line. Take the diameter of the generating circle is equal to 50 mm. 15

UNIT-II

3. (a) A straight line PQ has its end point P 10 mm above HP and 15 mm in-front of the VP. The line is 50 mm.

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long and its front and top views are inclined at an angle of 60° and 45° respectively. Draw the projections of the line PQ and find its inclinations with the HP and VP. 9

(b) A regular pentagon of 25 mm side has one side on the ground. Its plane is inclined at 45° to the HP and perpendicular to then VP. Draw its projections. 6

4. A cube of 30 mm sides rests with one of its edges on HP such that one of the square faces containing that edge is inclined at 30° to HP and the edge on which it rests being inclined to 60° to VP. Draw its projections. 15

UNIT-III

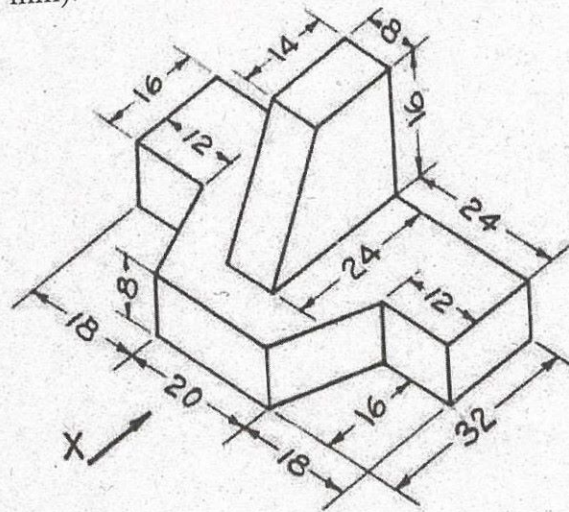
5. A cone of base 70 mm diameter and axis 90 mm long is resting on its base on HP. It is cut by a section plane perpendicular to the VP and parallel to and 15 mm away from one of its end generators. Draw the sectional top view, front view and sectional side view. Also draw the true shape of the section. 15

6. Draw the development of the lateral surface of the lower portion of a cylinder of diameter 50 mm and axis 70 mm. The solid is cut by a section plane inclined at 40° to H.P. and perpendicular to V.P. and passing through the midpoint of the axis. 15

UNIT-IV

7. Draw the front view, side view from the right, and top view of the block as shown in figure. (All dimensions are in mm).

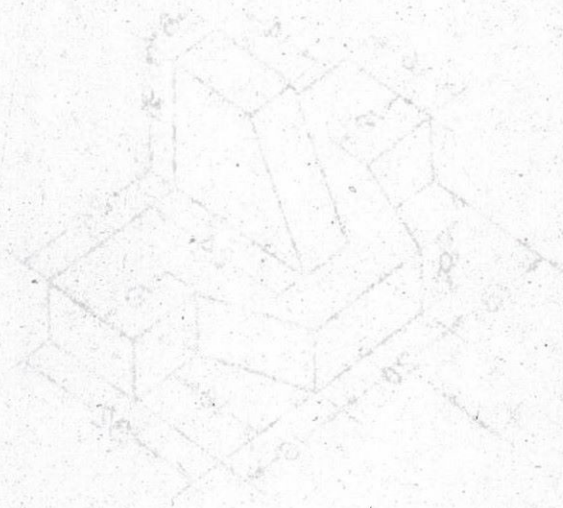
15



8. A square pyramid of side 30 mm, axis length 50 mm is centrally place over the top of a cube of side length 50 mm. Draw the isometric projections of the solids.

15

Draw the right side view from the left and top
views of the block as shown in figure. All dimensions
are in mm.



At each end of the shaft 30 mm diameter and length 30 mm
centrally placed over the top of a shaft of same length
30 mm diameter the conical portions of the shaft

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41042

ENGINEERING GRAPHICS & DESIGN

Paper-ES-109A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks. Assume any missing data.

UNIT-I

1. A map is to be drawn with R.F. 1:40. Construct a scale to read metres, decimetres and centimetres and long enough to measure up to 6 m. Show on it a distance of 3.84m. 15
2. Construct a cycloid having a rolling circle of 50 mm diameter. Draw a normal and a tangent to the curve at a point 35 mm above the base line. 15

UNIT-II

3. Draw the projections of following Points on a common reference line, taking a gap of 25 mm between two consecutive vertical projectors : 15
 - (a) Point P 30 mm above H.P. and 35 mm in front of V.P.

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- (b) Point Q 40 mm above H.P. and 20 mm behind V.P.
 - (c) Point R 25 mm HP and in V.P.
 - (d) Point T 35 mm below HP and 40 mm behind V.P.
4. A Line PQ 108 mm long has its plan and elevation lengths 60 mm and 90 mm respectively. One end of the line P is in HP while the other end is in VP. Draw its projections.

15

UNIT-III

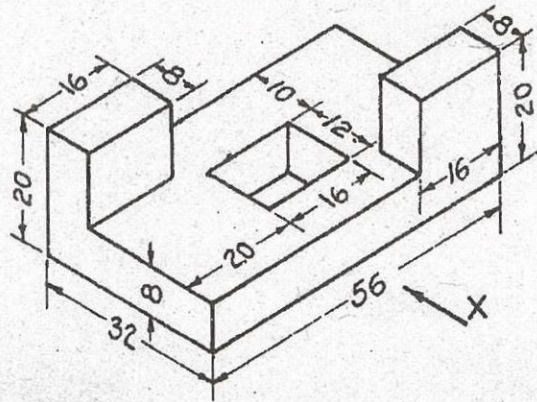
5. A cube of 30 mm sides is held on one of its corners on HP such that the bottom square face containing that corner is inclined at 30° to HP. Two of its adjacent base edges containing the corner on which it rests are equally inclined to VP. Draw the top and front views of the cube. 15
6. A hexagonal pyramid of side 30 mm and altitude 60 mm is resting on HP on its base with two of the base sides perpendicular to VP. The pyramid is cut by a plane inclined at 30° to HP and perpendicular to VP. The pyramid is cut by a plane inclined at 30° to HP and perpendicular to VP and is bisecting the axis. Draw the development of the remaining portion of the pyramid. 15

UNIT-IV

7. Draw the three orthographic views of Hexagonal Nut.

15

8. Draw the front view, top view and side view of the following object : 15



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Total Pages : 2

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41043

BIOLOGY

Paper-BS-141A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Enlist the characteristics features of living organism. 5
- (b) Draw a well labelled structure of Mitochondria. 5
- (c) Differentiate between Plant cell and Animal cell. 5
2. Why classification of Living organisms is important. Classify living organism based upon mode of Ammonia secretion and Energy and Carbon utilization. 15

UNIT-II

3. Define the Carbohydrates and Protein. Give two example of each. Discuss in detail functions of proteins and carbohydrates. 15
4. (a) Enlist the General characteristics of enzymes. 7

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- (b) Discuss in brief about different parameters that affect enzyme activity. 8

UNIT-III

5. Differentiate between stages of Mitosis and Meiosis. Also enlist significance of both these process in Cell physiology. 15
6. (a) Write down the Mendel's Law of inheritance. Also appreciate the significance of these laws in understanding of genetics. 10
- (b) Write down a short note on Diabetes type1 and Type 2. 5

UNIT-IV

7. (a) Why ATP is considered as energy currency of Cell. 5
- (b) Write down the first five reactions of Glycolysis along with names of Enzymes which catalyze these reactions. ~~Write down short note on.~~ 10
8. (a) Discuss in detail roles of Biology in agriculture, medicine and forensic science. 10
- (b) Write down a short note on Biosensors and their uses. 5

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41044

BASIC ELECTRICAL ENGINEERING

Paper-ES-101A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) A resistor R is connected in series with a parallel circuit comprising of two resistances 12 and 8 ohms respectively. The total power dissipated in the circuit is 96 watts when applied voltage is 24V. Calculate the value of R . 10
- (b) Explain Delta to Star transformation in case of resistor with diagram. 5
2. Find Thevenin's equivalent of circuit shown as Fig.1 (below), w.r.t. the load resistor of 12Ω . 15

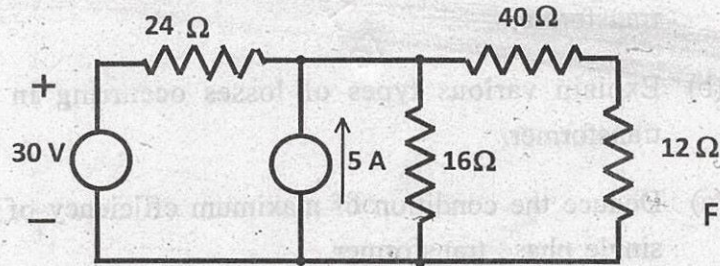


Fig.-1

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UNIT-II

3. Derive the expression for average and r.m.s. value of a periodic sine wave for full cycle. 15
4. (a) Explain in detail the theory of AC frequency response of series R-L-C circuit including resonance and various waveforms. 10
- (b) A series RLC circuit with $R = 20 \Omega$, $L = 800 \text{ mH}$ and $C = 12 \mu\text{F}$ is connected to an AC voltage source which has a maximum amplitude $V_m = 200 \text{ V}$, Find :
- (i) Resonant frequency ω_0 .
- (ii) The rms current at resonance.
- (iii) Let the driving frequency be $\omega = 2000 \text{ rad/s}$. then find compute Z and P.F. 5

UNIT-III

5. Explain in detail the two wattmeter method of power measurement for any type of (star or delta connected) load with suitable steps containing equations, neat circuit and phasor diagram. 15
6. (a) Describe the construction details of single phase transformer. 5
- (b) Explain various types of losses occurring in a transformer. 5
- (c) Deduce the condition of maximum efficiency of a single phase transformer. 5

UNIT-IV

7. Explain in detail the construction of a DC motor and working of commutator using neat sketches. 15
8. Explain the working principle of capacitor start capacitor run type single phase induction motor with neat circuit diagram. 15

QUESTION

1. Explain in detail the construction of a DC motor and its various parts.

2. Explain the working principle of a synchronous motor and its various parts.

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Total Pages : 2

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41045

SEMICONDUCTOR PHYSICS

Paper-BS-115A

Time Allowed : 3 Hours] [Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Explain the Nature of bond in Ice and NaCl. 7
(b) What do you mean by Point defects in solids? Derive an expression for concentration of Schottky defects in a crystal and how it depends on temperature. 8
2. (a) What are Miller indices and how are they determined? 7
(b) Explain three-dimensional Bravais lattices. 8

UNIT-II

3. (a) Define the Wave packet. What is the relation between phase velocity and group velocity associated with the wave packet. 8
(b) Derive Schrodinger time independent equation for matter waves. Give physical significance of the wave function. 7

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4. (a) Define the Heisenberg's uncertainty principle. Explain the existence of protons and alpha particles in nucleus using Heisenberg's Uncertainty Principle. 8
- (b) Explain the Origin of concept of wave particle duality on the basis of Quantum theory with example. 7

UNIT-III

5. (a) Explain the Kronig-Penney model. 7
- (b) Based on band theory of Solids distinguish between metals, insulators and semiconductor. 8
6. (a) Write short notes on the following : 8
- (i) E versus K diagram.
- (ii) Density of states.
- (b) Explain Hall effect and its applications. 7

UNIT-IV

7. (a) Explain the Working of Semiconductor laser. 7
- (b) What do you mean by Extrinsic Semiconductor? Derive an expression for carrier concentration in extrinsic semiconductor. 8
8. (a) Explain the working and current-voltage characteristics of p-n junction. 8
- (b) Explain the construction and working of Field effect Transistor. 7

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41046

CALCULUS & LINEAR ALGEBRA

Paper-BS-133A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Express the integral $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$ in terms of Gamma function.

(b) Verify Rolle's Theorem for the function $(x-a)^m(x-b)^n$ where m, n are positive integers in $[a, b]$.

2. (a) Evaluate : $\lim_{x \rightarrow 0} \frac{(1+x)^{\frac{1}{x}} - e}{x}$.

(b) Find the Volume formed by the Revolution of loop of the curve $y^2(a+x) = x^2(3a-x)$ about x -axis.

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UNIT-II

3. (a) If $A = \begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}$ and I is the unit matrix of order 2, evaluate $A^2 - 6A + 8I$.

- (b) Find the rank of the matrix $\begin{bmatrix} 3 & 4 & 1 & 2 \\ 3 & 2 & 1 & 4 \\ 7 & 6 & 2 & 5 \end{bmatrix}$.

4. (a) Solve the following equations by Cramer's rule.

$$x + y + z = 4$$

$$x - y + z = 0$$

$$2x + y + z = 5.$$

- (b) Find the inverse of the matrix $A = \begin{bmatrix} 3 & 1 & 2 \\ 2 & -3 & -1 \\ 1 & 2 & 1 \end{bmatrix}$ and

verify $A^{-1}A = I$, where I is the identity matrix of order 3.

UNIT-III

5. (a) Show that the vectors $(1, -2, 1)$, $(2, 1, -1)$ and $(7, -4, 1)$ are linearly dependent in $\mathbb{R}^3(\mathbb{R})$.
- (b) Show that the set $\{(2, -1, 0), (3, 5, 1), (1, 1, 2)\}$ forms a basis of \mathbb{R}^3 .

6. (a) State and Prove rank and nullity theorem.
- (b) Let $T: R^3 \rightarrow R^3$ be a linear operator defined by $T(x, y, z) = (x+z, x-z, y)$, show that T is invertible.

UNIT-IV

7. (a) Find the eigen values and eigen vectors of the matrix

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}.$$

- (b) If A is square matrix, show that :

- (i) $A + A'$ symmetric.
- (ii) $A - A'$ is skew-symmetric.

8. (a) Find the values a, b, c if $A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ is

orthogonal.

- (b) Let $V(F)$ be an inner product space. If $u, v \in V$ such that $|\langle u, v \rangle| = \|u\| \cdot \|v\|$, then show that u and v are linear dependent.

