

Roll No. ....

Total Pages : 2

BT-2/M-22

42022

## APPLIED PHYSICS-II

Paper-AS-102N

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) Name different types of bonding in solids. Give examples. 7
- (b) What do you mean by point defects in solids? Derive an expression for concentration of Schottky defects in a crystal. 8
2. (a) Explain NaCl and CsCl crystal structure. 8
- (b) Explain two-dimensional and three-dimensional Bravais lattice. 7

## UNIT-II

3. (a) What are De-Broglie waves? Show that the De-Broglie group velocity associated with the wave packet is equal to the velocity of the particle. 8
- (b) Derive Schrodinger time independent equation for matter waves. Give physical significance of the wave function. 7
4. (a) Explain the existence of protons, neutrons and alpha particles in nucleus using Heisenberg's Uncertainty principle. 8

- (b) Explain the concept of wave particle duality with examples. 7

### UNIT-III

5. (a) Based on band theory of solids distinguish between metals, insulators and semiconductor. 8  
(b) Derive expression for effective mass of an electron moving in a periodic potential. 7
6. (a) Write short notes on the following : 8  
(i) Fermi Energy.  
(ii) E versus K diagram.
- (b) Explain Hall effect and its applications. 7

### UNIT-IV

7. (a) Explain Meissner effect in superconductivity. 7  
(b) Explain Sol-Gel and Ball Milling methods for synthesis of nanomaterials. 8
8. (a) Derive London's equations with reference to superconductivity. 8  
(b) Explain various applications of nonmaterial's. 7

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Total Pages : 3

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42023

## APPLIED CHEMISTRY

Paper-AS-103N

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) Derive Clausius-Clapeyron equation for Liquid-vapour equilibrium. Also give its significance. 6
- (b) The entropy change in a reversible process is always zero whereas for irreversible process is always +ve. Justify this statement. 3
- (c) Define Chemical potential, Homogeneous system, Intensive property, Isothermal process and work function. 2,1,1,1,1
2. (a) Explain the phase diagram of Pb-Ag system. 6
- (b) Derive Phase rule equation. Also define the terms-phase, component and Degree of freedom. 6
- (c) Define first law of Thermodynamics. Give its limitations also. 3

### UNIT-II

3. (a) Define the terms-Hardness and alkalinity of water. Describe EDTA method for hardness determination. 7

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P. T. O.

- (b) What are ionic Liquid? How are they superior to traditional solvents used in reactions. 4
- (c) What are scale and sludge. Give their composition and methods of prevention of scale formation. 4
4. Write notes on the following :
- (a) Softening of water by ion-exchange resins.
- (b) Twelve principles of Green chemistry.
- (c) Electrodialysis for desalination.  $5 \times 3 = 15$

### UNIT-III

5. (a) What is Dry corrosion? Describe different types of dry corrosion. 5
- (b) Explain the following :
- (i) Water line corrosion.
- (ii) Cathodic and anodic protection for corrosion prevention. 4,6
6. Write notes on the following :
- (a) Thin film Lubrication.
- (b) Viscosity index.
- (c) Solid Lubricants.
- (d) Consistency of greases. 3,4,4,4

### UNIT-IV

7. (a) What are nanowires? Write its properties and applications. 4

(b) Explain the structure, characteristics and types of fullerenes. Also give their applications. 8

(c) Define Porcelain. Write its properties and uses. 3

8. Write briefly about the following :

(a) Process of production of Portland cement.

(b) Dendrimers.

(c) Carbon nanotubes. 5,4,6

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Total Pages : 3

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42025

APPLIED MATHEMATICS-II

Paper-AS-104N

Time Allowed : 3 Hours]

[Maximum Marks : 75

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

UNIT-I

1. (a) Define reciprocal equation and its types. Find the equation whose roots are exceeding the roots of equation :

$$x^5 - 6x^4 - 3x^3 + 2x^2 + 5x + 1 = 0 \text{ by } 1.$$

(b) Define Beta and Gamma functions. Derive the relation between Beta and Gamma function,  $\beta(m, n) = \Gamma(m)\Gamma(n) / \Gamma(m+n)$ .

2. Using the method of differentiation under the integral sign, evaluate :

$$\int_0^{\infty} \frac{\tan^{-1}(ax)}{x(1+x^2)} dx.$$

UNIT-II

3. (a) Find the Laplace transform of  $L\left(\frac{\cos 4t \sin 2t}{t}\right)$ .

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P. T. O.

(b) Find the inverse Laplace transform of :

$$\left( \frac{s-3}{s^2+3s+2} \right).$$

4. Solve by Laplace transform the differential equation

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = e^{-t} \sin t, \quad y(0) = 0, \quad y'(0) = 1.$$

### UNIT-III

5. (a) Solve the differential equation  $y(2xy + e^x)dx - e^x dy = 0$ .

(b) Suppose that an object is heated to  $200^\circ\text{C}$  and allowed to cool in a room whose air temperature is  $70^\circ\text{C}$ . After 8 minutes the temperature of the object is  $150^\circ\text{C}$ . What will be its temperature after 15 min?

6. (a) Solve the differential equation

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = (1 - e^x)^2.$$

(b) Solve  $(2x+3)^2 \frac{d^2y}{dx^2} - (2x+3) \frac{dy}{dx} - 12y = 6x$ .

### UNIT-IV

7. (a) Find the directional derivative of  $\phi = x^2y - y^2x + z^2x$  at the point  $P(1, 2, 1)$  in the direction of the line :

$$\frac{x-2}{3} = \frac{y-3}{-2} = z.$$

(b) Discuss the physical interpretation of divergence.

8. Using divergence theorem, evaluate

$$\int_S \mathbf{F} \cdot \mathbf{N} ds$$

where  $\mathbf{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$  and  $S$  is the surface bounding the region  $x^2 + y^2 = 4$ ,  $z = 0$  and  $z = 3$ .

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Total Pages : 3

BT-2/M-22

42028

**ENGINEERING DRAWING AND GRAPHICS**

Paper-105N

Time Allowed : 3 Hours]

[Maximum Marks : 75

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

**UNIT-I**

1. (a) Two points A and B are on HP. The point A is 35 mm in front of VP, while B is 50 mm behind VP. The line joining their top views makes an angle of  $40^\circ$  with XY. Find the horizontal distance between the two projectors. 6
- (b) Draw all the three views of a point P lying 60 mm below HP, 70 mm in front of VP and 40 mm from RPP. Also state the quadrant in which it lies. 9
2. A line PQ has its end P, 10 mm above the HP and 20 mm in front of the VP. The end Q is 85 mm in front of the VP. The front view of the line measures 75 mm and the distance between the end projectors is 50 mm. Draw the projections of the line and find its true length and its true inclinations with the VP and HP and locate its traces. 15

**UNIT-II**

3. A pentagonal lamina of edges 25 mm is resting on HP with one of its corners such that the edge opposite to this corner is 20 mm above HP and makes an angle of  $45^\circ$  with VP. Draw the top and front views of the lamina in this position. Determine the inclination of the lamina with HP. 15

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P. T. O.

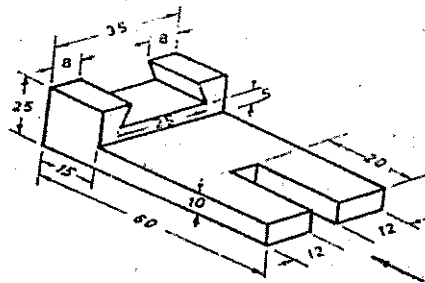
4. Draw the projections of a hexagonal prism of base side 20 mm and axis length 50 mm when it rests on the ground on one of its base edges and the axis inclined at  $35^\circ$  to the ground and parallel to VP. 15

### UNIT-III

5. A hexagonal prism of side of base 20 mm and length 60 mm rests on HP with its axis being vertical and one edge of its base inclined at  $15^\circ$  to VP. The solid is cut by a plane perpendicular to VP and inclined at  $40^\circ$  to HP and bisecting the axis of the prism. Draw the projections of the prism and true shape of the section. 15
6. A regular pentagonal pyramid of side of base 35 mm and altitude 65 mm has its base on HP with a side of base perpendicular to VP. The pyramid is cut by a section plane which is perpendicular to VP and inclined at  $30^\circ$  to HP. The cutting plane meets the axis of the pyramid at a point 30 mm below the apex. Draw the development of the remaining part of the pyramid. 15

### UNIT-IV

7. Draw the front view, top view and side views of the dove tail stop as shown in figure. All dimensions in mm. The front view direction is marked with a long arrow. Any missing dimensions may be assumed. 15



8. (a) With the help of diagram, differentiate absolute and relative coordinates system. State their relative applications. 6
- (b) Explain the following AUTOCAD commands : 9
- (i) Chamfer.
  - (ii) Offset
  - (iii) Mirror.

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Total Pages : 3

BT-2/M-22

42031

## ELECTRICAL TECHNOLOGY FUNDAMENTALS

Paper-EE-101N

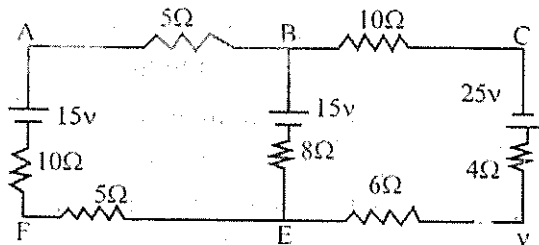
Time Allowed : 3 Hours]

[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 Nodal current method with example in details. 5
  - (b) Explain Superposition and maximum power transfer theorem in brief. 5
  - (c) Three resistors 12 ohm, 18 ohm and 36 ohm are connected in parallel. This parallel circuit is connected in series with a resistor 'R'. The whole circuit is connected to supply of 60 Volt and it is found that power developed in 12 ohm resistor is 48 watts. Determine the value of R and total power. 5
2. Find both the Norton's and Thevenin's equivalent circuits w.r.t. the load resistor of  $8\ \Omega$  in the network shown below. 15



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P. T. O.

## UNIT-II

3. (a) Two coils A and B are connected in series across a 240 V, 50 Hz supply. The resistance of A is 5 ohm and the inductance of B is 0.015H. If the input from the supply is 3KW and 2KVAR, find the inductance of A and resistance of B. 5
- (b) Derive the resonant frequency of a standard parallel circuit (C Paralleled with RL). 5
- (c) Convert a delta connected set of unequal resistors into star. 5
4. (a) Explain in detail the theory of sinusoidal frequency response of series RLC ckt. including condition of resonance. 10
- (b) What do you mean by power factor? Explain its importance. 5

## UNIT-III

5. (a) Establish relation between line voltage and phase voltage in a 3 phase star connected balanced power system. 5
- (b) Explain in detail the two wattmeter method of power measurement for a star connected inductive load (RL series) for  $[\pi/6 > \theta]$  with suitable steps containing equations, ckt and phasor diagram. And also explain the effect of power factor on two wattmeter readings. 10

6. (a) Draw and explain equivalent circuit of a 1-phase transformer when Secondary parameters referred to primary side. Also write label (name/meaning) of each parameter. 5
- (b) Explain open and short circuit test on single phase transformer. 5
- (c) Explain the concept of auto transformer. 5

#### UNIT-IV

7. (a) Explain the working principle of three phase Induction Motor. 5
- (b) Derive the equation for back EMF developed in DC Motor. 5
- (c) Describe speed control of D.C Shunt Motor with circuit diagrams. 5
8. Write short notes on any **three** of the following : 15
- (a) Squirrel Cage Induction Motor.
- (b) Slip and its significance.
- (c) Synchronous Generator.
- (d) Commutator.

Roll No. ....

Total Pages : 2

BT-2/M-22

42033

## SEMICONDUCTOR PHYSICS

Paper-BS-115-A

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 lattice translation vector and symmetry operations in a crystal. 7
- (b) What do you mean by point defects in solids? Derive an expression for concentration of Frenkel defects in a crystal. 8
2. (a) Explain hcp structure. Calculate its packing fraction. 7
- (b) Explain two-dimensional and three-dimensional Bravais lattice. 8

### UNIT-II

3. (a) What are De-Broglie waves? What is the relation between De-Broglie group velocity associated with the wave packet and velocity of the particle. 8
- (b) Derive Schrodinger time independent equation for matter waves. Give physical significance of the wave function. 7

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4. (a) Explain the non existence of electron in nucleus using Heisenberg's uncertainty principle. 8  
(b) Explain the concept of wave particle duality with examples. 7

### UNIT-III

5. (a) Based on band theory of solids distinguish between metals, insulators and semiconductor. 8  
(b) Explain the electrical conductivity in metals using classical free electron theory. 7
6. (a) Write short notes on the following : 8  
(i) Fermi Energy.  
(ii) Brillion zone.  
(b) Explain Hall effect and its applications. 7

### UNIT-IV

7. (a) Explain the working and characteristics of Bipolar Junction Transistor. 8  
(b) What do you mean by extrinsic semiconductor? Derive an expression for carrier concentration in extrinsic semiconductor. 7
8. (a) Describe the formation of p-n junction. Discuss its current voltage characteristics. 8  
(b) Explain the construction and working of semiconductor laser. 7

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Total Pages : 3

BT-2/M-22

42034

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) Write the main features of Molecular Orbital Theory. Using this theory, explain that out of following species. Which has the shortest bond length-  $\text{CO}^{+1}$ ,  $\text{CO}$  and  $\text{CO}^{-1}$ . 7
- (b) Describe pi-molecular orbitals of benzene and also explain stability of benzene. 5
- (c) Define Aromatic compounds. Describe different types of aromatic compounds with examples. 3
2. (a) Describe Band theory for solids. Give the different types of solid based on Band theory. Also explain the semiconductors in detail. 8
- (b) Write a note on Crystal Field Theory. Explain the magnetic behaviour of  $[\text{Co}(\text{NH}_3)_6]^{3+}$  using this theory. 7

### UNIT-II

3. (a) Explain the following :  $4\frac{1}{2} \times 2 = 9$ 
  - (i) MRI and its applications.

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P. T. O.

- (ii) Molecular vibrations in IR spectroscopy.
- (b) Define following terms :  $1\frac{1}{2} \times 4 = 6$
- (i) Chemical shift.
  - (ii) Hyperchromic shift.
  - (iii) Bathochromic shift.
  - (iv) Hypsochromic shift.
4. (a) Describe the electromagnetic spectrum. Also explain various electronic transitions possible in different organic molecules. 7
- (b) Write note on the following :  $4 \times 2 = 8$
- (i) Fluorescence and its applications.
  - (ii) Scattering of light and its significance.

### UNIT-III

5. (a) On basis of VSEPR theory, account for the following order of bond angles. 3
- $$\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se}.$$
- (b) Why CuCl is less soluble in water than NaCl. 3
- (c) Define term. Electronegativity. Describe the factors affecting Electronegativity. Also give its significance. 6
- (d) Give the reason for filling of 4s orbital earlier than 3d orbital using the concept of Effective Nuclear charge. 3
6. (a) Derive Nemst equation. Give its significance also. 5
- (b) Write different statements for Second Law of thermodynamics. 2

- (c) Derive an equation/expression for change in Entropy of an ideal gas. 5
- (d) Calculate entropy increase in the evaporation of one mole of water at 100°C. Heat of vaporisation of water at 100°C is 2259.4 J/gram. 3

#### UNIT-IV

7. (a) Define the term-Isomer. Explain different types of structural isomers with suitable examples. 6
- (b) Give differences between Diastereomers and Enantiomers using proper examples. 4
- (c) What is  $\beta$ -elimination. Distinguish between  $E_1$  and  $E_2$  mechanism of elimination taking suitable examples. 5
8. Write notes on the following :
- (a) Free radical substitution reaction.
- (b) CIP rules for assigning priorities in R/S configuration system.
- (c) Conformations of Cyclo hexane.
- (d) Ring-opening reaction. 4,3,5,3

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Total Pages : 2

BT-2/M-22

42035

**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) Explain working of a computer along with its block diagram in detail. 7½
- (b) Differentiate between machine, assembly and high-level languages. 7½
2. (a) What is a flowchart? Draw a flowchart to find maximum of n numbers. 7½
- (b) Convert  $(64.25)_{10}$  to binary, octal and hexadecimal numbers. 7½

**UNIT-II**

3. (a) Explain various data types available in 'C'. 7½
- (b) Discuss different storage classes in C language in brief. 7½
4. (a) Describe the various input and output functions in C language using suitable examples. 7½
- (b) Write a program in C to find roots of a quadratic equation. 7½

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P. T. O.

### UNIT-III

5. (a) What do you understand by function? Explain the various benefits of using functions. 7½  
(b) Write a user-defined function in C to compare two strings and identify that whether two string are equal. If not, which string is greater? 7½
6. (a) Write down a program in 'C' to search a number from a given list of numbers. 7½  
(b) What is recursion? Write down a recursive program to generate Fibonacci sequence of numbers. 7½

### UNIT-IV

7. (a) What is a pointer? What are the various operations that can take place on pointers? Explain using suitable examples in brief. 7½  
(b) Explain advantages and disadvantages of structures and union. 7½
8. How can you create and use a file in C language? Write a program in C to read the contents of a file and copy these contents to another file. 15

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Total Pages : 7

BT-2/M-22

42036

ENGLISH

(COMMON WITH CSE, IT, ECE, EE, EEE)

Paper-HM-101A

Time Allowed : 3 Hours]

[Maximum Marks : 75

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

1. (a) Write **two** synonyms for the following words given any 8.

1×8=8

ugly, contemplation, handsome, rage, pensive, stunning,  
tedious, brave, hope, captivating.

(b) Write **one** appropriate antonym for the following words  
given any 7.

1×7=7

back, sharp, marvelous, transparent, bold, partial,  
cautious, cool, easy.

2. From **two** suitable words from the following prefix and suffix  
given :

15

(i) a .....

(ii) anti .....

(iii) di .....

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- (iv) ab .....
- (v) an .....
- (vi) eu .....
- (vii) un .....
- (viii) en .....
- (ix) ..... ies
- (x) ..... ess
- (xi) ..... ward
- (xii) ..... ed
- (xiii) ..... ship
- (xiv) ..... esque
- (xv) ..... ism

3. (a) Make sentences from the following phrases :  $1 \times 8 = 8$

- (i) Spill the beans
- (ii) Sat on fence
- (iii) Better late than never
- (iv) Hit the sack
- (v) Once in a blue moon
- (vi) Bite the bullet
- (vii) Stabbed in the back

(viii) Pull off.

(b) Punctuate the following sentences :  $1 \times 7 = 7$

(i) He said listen to the noise with eyes closed

(ii) Shut the door

(iii) We visited her this morning the nurse told

(iv) She came to see her

(v) The following colors are primary colors red blue  
and green

(vi) I want to leave said Meera

(vii) You can wait she might turn up

4. Discuss in brief the organizing principles of paragraph writing  
with suitable examples. 15

5. (a) Fill in the blanks with most appropriate word given in  
the parenthesis :  $1 \times 10 = 10$

(i) They came ..... (to/was) meet me, but I  
..... (was/were) out of town at that time.

(ii) Propose to the person you are stranded on a  
desert..... (isle/aisle) with and maybe you'll  
march down ..... (isle/aisle) together after  
you are rescued.

(iii) ..... (a/an) apple ..... (a/an) keeps  
the doctor away:

(iv) Why ..... (is/are) she waiting in the lobby?

(v) Can you please ..... (give/gives) me a loan?

(vi) You can ..... (see/saw) her provided he..... (agrees/agreed).

(b) Fill in the blanks in the following sentences with appropriate forms of the verb given in the brackets : 5

(i) We ..... for the station. (leave)

(ii) Although they tried hard, yet they ..... not fix the machine. (can).

(iii) It ..... since morning. (rain)

(iv) My aunt ..... me a shirt for my birthday. (give)

(v) What ..... you do then? (are)

6. Correct the following sentences : 15

(i) I have visited Shimla last weekend.

(ii) They is going to regret.

(iii) I live in United States.

(iv) She doesn't listen me.

(v) My flight departs in 5:00 am.

(vi) They is coming.

(vii) Every girl must bring their own boxes.

- (viii) Its a cold day.
- (ix) These recipes is good for beginners.
- (x) What reason did he come for?
- (xi) There father went to the school.
- (xii) I am doing good in science.
- (xiii) My hair is smoother and softer.
- (xiv) She gave me a real nice bouquet of flowers.
- (xv) Around a world in 80 days.

7. Write an essay on any **one** of the following topics given (500 words) : 15

- (i) Cybercrime in India
- (ii) Media
- (iii) Post-Covid World
- (iv) Ethics and Values

8. Read the following passage and write a precis : 15

According to Russell, it is the philosopher's job to discover a logically ideal language— a language capable of describing the world in such a way that we will not be misled by the accidental, imprecise surface structure of natural language. As Russell writes, "Ordinary language is totally unsuited for expressing what physics really asserts, since the words of everyday life are not sufficiently abstract. Only mathematics

and mathematical logic can say as little as the physicist means to say". Just as atomic facts (the association of properties and relations with individuals) combine to form molecular facts in the world itself, such a language will allow for the description of such combinations using logical connectives such as "and" and "or". In addition to the existence of atomic and molecular facts, Russell also held that general facts (facts about "all" of something) are needed to complete our picture of the world. Famously, he vacillated on whether negative facts are also required.

The reason Russell believes many ordinarily accepted statements are open to doubt is that they appear to refer to entities that may be known only through inference. Thus, underlying Russell's various projects was not only his use of logical analysis, but also his long-standing aim of discovering whether, and to what extent, knowledge is possible. "There is one great question," he writes in 1911. "Can human beings *know* anything, and if so, what and how? This question is really the most essentially philosophical of all questions" (quoted in Slater 1994, 67).

Motivating this question was the traditional problem of the external world. If our knowledge of the external world comes through inferences to the best explanation, and if such inferences are always fallible, what guarantee do we have that our beliefs are true? Russell's response to this question was partly metaphysical and partly epistemological. On the metaphysical side, Russell developed his famous theory of logical atomism,

in which the world is said to consist of a complex of logical atoms (such as "little patches of colour") and their properties and relations. (This theory was crucial for influencing Wittgenstein's theory of the same name.) Together these atoms and their properties form the facts which, in turn, combine to form logically complex objects. What we normally take to be inferred entities (for example, enduring physical objects) are then understood as logical constructions formed from the immediately given entities of sensation.

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Total Pages : 3

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42037

**PROBABILITY AND STATISTICS**

Paper-BS-134A

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**

- (a) State and prove addition theorem of probability for n events.  
(b) Prove the multiplication rule of probability.
- A random variable X has the following probability mass functions :

$$P(x) = \begin{cases} 1/4; & \text{for } x = -2 \\ 1/4; & \text{for } x = 3 \\ 1/2; & \text{for } x = 6 \\ 0 & \text{otherwise} \end{cases}$$

Evaluate :

(i)  $P(2x - 3 > 1)$

(ii)  $P(x^2 - 2x \leq 3)$

(iii)  $P|x| < 1$

(iv) Find distribution function.

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## UNIT-II

3. (a) Show that Normal distribution is a limiting case of binomial distribution.  
(b) Find the mode of the Poisson distribution with mean value 5.
4. Discuss the following terms with the help of example :
  - (a) Continuous Random Variable.
  - (b) Probability Density Function.
  - (c) Expectation of Continuous Random Variable.
  - (d) Distribution Function.

## UNIT-III

5. (a) Show that the co-efficient of correlation is independent of change of scale and origin of the variables and state the limits between co-efficient of correlation lies.  
(b) Show that the coefficient of correlation is the geometric mean of coefficients of regression.
6. The median and mode of the following wage distribution are known to be Rs. 33.5 and Rs. 34 respectively. Find the values of A, B and C :

Wage(in Rs.) :	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of person:	4	16	A	B	C	6	4

Total number of person is 230.

## UNIT-IV

7. Random sample drawn from two countries gave the following data relating to the heights of adult males :

	Country A	Country B
Mean Height (in inches)	87.51	87.31
Standard Deviation (in inches)	3.6	3.58
Number in samples	1000	1200

- (i) Is the difference between the means significant at 5% level of significance?
- (ii) Is the difference between the standard deviations significant at 5% level of significance?
8. (a) Explain in detail fitting of a polynomial of degree  $m$ .
- (b) A random sample of 10 student's marks in Mathematics and Statistics are given below. Test whether the correlation exists between the marks of two subjects at 5% level of significance. ( $t_{0.05} = 2.36$  for 08 degree of freedom)

Marks in Mathematics : 68 54 78 75 76 85 54 68 87 75

Marks in Statistics : 59 68 72 67 72 78 64 58 68 74

Roll No. ....

Total Pages : 2

BT-2/M-22

42038

## ENGINEERING GRAPHICS AND 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.

### UNIT-I

1. (a) What is the significance of Engineering Drawing. 8  
(b) Discuss various types of scales used in Engg. Drawing. 7
2. Define following : 15  
(a) Cycloid. (b) Involute.  
(c) Hyperbola.

### UNIT-II

3. Draw the projection of points on common reference line, considering distance between projectors as 30 mm. 15  
(a) Point A, 25 mm above HP, and 25 mm behind VP.  
(b) Point B, 20 mm Below HP, 25 mm behind VP.  
(c) Point C, Both in HP and VP.  
(d) Point D, in the HP, and 25 mm behind VP.

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P. T. O.

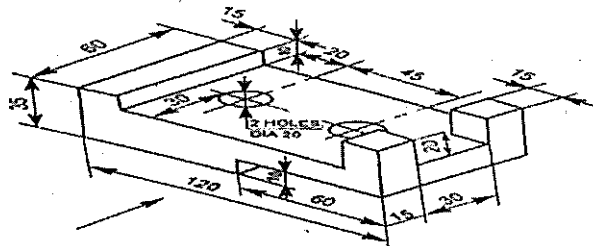
4. A straight line AB having length 50 mm is inclined  $45^\circ$  to HP and  $30^\circ$  to VP. Draw the projection of line AB if its one end A is 15 mm above HP and 10 mm in front of VP. 15

### UNIT-III

5. A pentagonal pyramid of base side 25 mm and axis 55 mm is resting on its base in the H.P. with an edge of the base parallel to the V.P. A horizontal section plane cuts the pyramid bisecting the axis. Draw its front view and top sectional top view. 15
6. A cylinder 50 mm in diameter and 65 mm long is resting on its base with its axis perpendicular to HP. It is cut by a cutting plane perpendicular to VP, inclined  $45^\circ$  to HP and passing through a point on the axis, 25 mm from the top. Draw the front view, sectional top view and development of the lateral surface of the cylinder. 15

### UNIT-IV

7. (a) Draw the construction of isometric scale. 15  
 (b) Give the isometric views of plane by considering suitable examples.
8. Draw the orthographic view of the solid shown below : 15



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**ENGINEERING GRAPHICS AND DRAWING**

Paper-ES-109A

Time Allowed : 3 Hours]

[Maximum Marks : 75

**Note** : Attempt **five** questions in all, selecting at least **one** question from each Unit. Unless stated otherwise, the symbols have their usual meaning in context with the subject. Assume suitably and state, additional data required, if any.

**UNIT-I**

1. Draw the orthographic projections of the following points. 15
- (a) Point P is 30 mm above HP and 40 mm in front of VP.
  - (b) Point Q is 25 mm above HP and 35 mm behind VP.
  - (c) Point R is 32 mm below HP and 45 mm behind VP.
  - (d) Point S is 35 mm below HP and 42 mm in front of VP.
  - (e) Point T is in HP and 30 mm is behind VP.
  - (f) Point U is in VP and 40 mm below HP.
  - (g) Point V is in VP and 35 mm above HP.
  - (h) Point W is in HP and 48 mm in front of VP.

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**P. T. O.**

2. A line PQ is in first quadrant. Its ends P and Q are 15 mm and 45 mm in front of the VP, respectively. The distance between the end projectors is 55 mm. The line is inclined at  $30^\circ$  to the HP and its HT is 8 mm above the XY line. Draw the projections of the line PQ and find its TL and locate its VT. 15

### UNIT-II

3. A regular hexagonal lamina, 20 mm, rests on HP on one of its sides such that it is perpendicular to the HP and inclined to VP at  $30^\circ$ . Draw its projections, in first angle, when the corner nearest to the VP is 15 mm away from it. 15
4. A right regular pentagonal prism, edge of base 25 mm and height 55 mm, rests on an edge of its base in HP such that its axis is parallel to VP and (i) its base makes an angle  $45^\circ$  to HP, (ii) one of its rectangular faces is perpendicular to VP and inclined to HP at  $45^\circ$ . Draw the projections of the prism held in the given position. 15

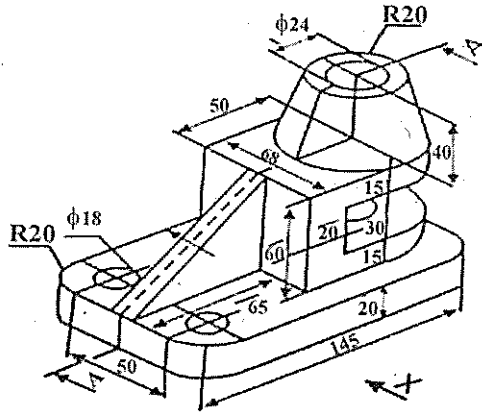
### UNIT-III

5. A cylinder of 40 mm diameter, 60 mm height and having its axis vertical, is cut by a section plane, perpendicular to the VP, inclined at  $45^\circ$  to HP and intersecting the axis 32 mm above the base. Draw its front view, sectional top view, sectional side view and true shape of the section. 15
6. A right circular cone, diameter of base 50 mm and height 62 mm, lies on HP on one of its elements, with its axis parallel to VP. Draw the projections of the cone. 15

## UNIT-IV

7. Draw the top, front and side views of the following object:

15



8. Explain in detail, the following commands used in AUTOCAD:

15

- (a) Fillet.
- (b) Chamfer.
- (c) Trim.

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Total Pages : 2

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**42040**

**BIOLOGY**

Paper-ES-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. Draw the ultrastructure of cell and explain any two organelles. 15
2. (a) Classify the organisms on basis of Energy and carbon utilization. 15
- (b) Differentiate between plant and animal cell. 15

**UNIT-II**

3. Explain different types of protein structures. 15
4. Explain different classes of enzymes and write about enzyme action. 15

**UNIT-III**

5. Explain types of cell division and their significance. 15
6. What are the morphological features for characterization of Fungi and virus how are they beneficial for human beings. 15

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**P. T. O.**

## UNIT-IV

7. Explain the process of glycolysis. 15
8. Write notes on the following :
- (a) BIOMEMS
  - (B) Biosensors. 15

## BASIC ELECTRICAL ENGINEERING

Paper-ES-101A

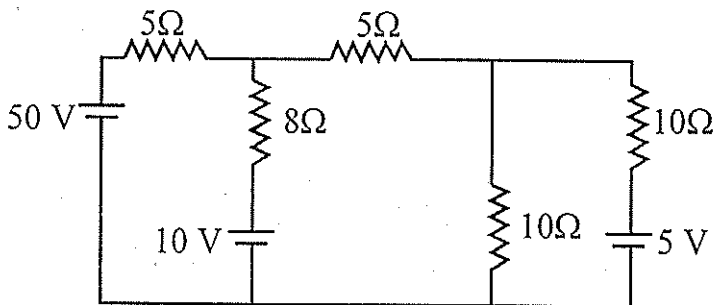
Time Allowed : 3 Hours]

[Maximum Marks : 75

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

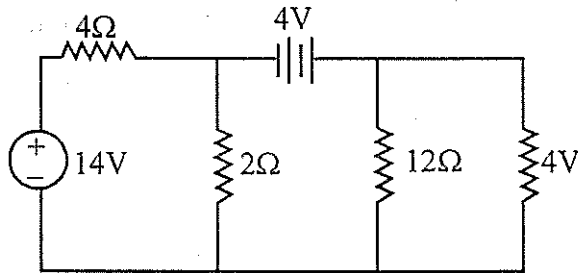
## UNIT-I

1. (a) A  $50\Omega$  resistance is connected across a  $10\text{ V}$  battery. What is the current through the resistor? Find the energy consumed in  $8\text{ s}$ . 2½



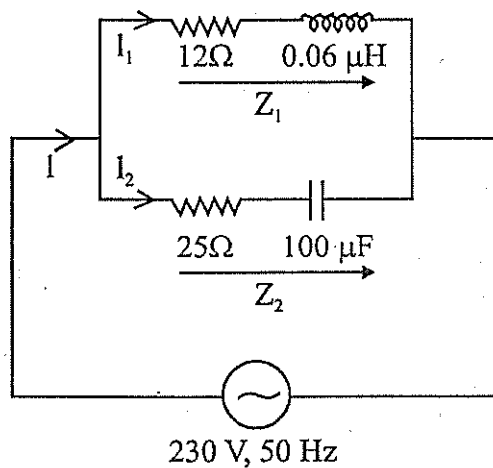
- (b) The resistance of two wires is  $25\Omega$  when connected in series and  $6\Omega$  when joined in parallel. Calculate the resistance of each wire. 2½
- (c) For the circuit shown in figure, find out the current in each branch by Nodal Voltage Analysis. 10

2. (a) Define maximum power transfer theorem. Describe the condition for maximum power transfer with the help of circuit diagram. 5
- (b) Find out the voltage drop across  $12\ \Omega$  resistance using Norton's theorem for the circuit shown in Figure. 10



### UNIT-II

3. (a) Find out the current through each branch shown in figure. 8



- (b) What do you mean by average and RMS value? Describe and find out the expression related to them. 7
4. (a) Draw and explain variation of R, L, C, I and power factor with variation of frequency in series RLC circuit. 5
- (b) Derive the expression for resonance frequency in series RLC circuit. 10

### UNIT-III

5. (a) A 3-phase, 3-wire supply feeds a load which consists of three equal resistance having value R ohms. If one of the resistance is removed, then how much percentage load is reduced when the load is (a) star connected and (b) delta connected. 5
- (b) With the aid of phasor diagram show that three phase power and power factor can be measured by using two watt meters. 10
6. (a) Explain the working of single phase transformer in brief. 5
- (b) What do you mean by open circuit and short circuit test? Describe the various steps to conduct these tests on single phase transformer and outcomes of them. 10

### UNIT-IV

7. (a) What do you mean by DC machine? Explain the role of commutator in DC machine. 5
- (b) What are the different methods for speed control of DC motor? Write short note. 5

- (c) Describe the explain the synchronous machine in brief. 5
8. Write short notes on the following : 15
- (a) Single phase induction machine.
  - (b) Different type of fuses used in electrical installations.
  - (c) Various types of wire and cables.

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Total Pages : 2

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42042

## INTRODUCTION TO ELECTROMAGNETIC THEORY

Paper-BS-119A

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. Write short notes on the following :

- (a) Curl of a vector field and its physical significance. 5
- (b) Laplace Equation and its physical significance. 5
- (c) Poisson's Equation and its physical significance. 5

- 2. (a) Explain in detail Gauss law in electrostatics. 7
- (b) Find the expression for Electric field at different regions (at center, inside, on the surface and outside) for charged dielectric solid sphere. 8

### UNIT-II

- 3. (a) Explain Polarization in dielectrics and the field of a dielectric object. 7
- (b) Explain energy in dielectric systems and forces in dielectric. 8

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4. Write short notes on the following :
- (a) Susceptibility. 5
  - (b) Dielectric constant. 5
  - (c) Linear dielectric. 5

### UNIT-III

5. Explain the following :
- (a) Divergence of magnetic field. 5
  - (b) Bound currents and its physical significance. 5
  - (c) Ferromagnetism. 5
6. (a) Explain the concept of vector magnetic potential. What is its unit? Explain, though being a potential, it is a vector quantity. 10
- (b) Explain Ampere's Law in magnetised material. 5

### UNIT-IV

7. Write down the Maxwell's equations in integral and differential forms and discuss the physical significance/circuit relations/field theory concept possessed by each equation. 15
8. (a) Deduce the equation for the propagation of plane electromagnetic waves in linear media. 10
- (b) Draw a neat and labelled diagram of a propagating plane electromagnetic wave with all the associated fields. 5

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Total Pages : 3

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42043

**CALCULUS AND ORDINARY  
DIFFERENTIAL EQUATIONS**

Paper-BS-136A

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 :  $\frac{dy}{dx} + \frac{1}{x}y = x^2 - 3$ .

(b) Solve :  $(e^y + 1) \cos x \, dx + e^y \sin x \, dy = 0$ .

2. (a) Solve :  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 2y = \sin h x$ .

(b) Solve :  $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = e^x$ .

**UNIT-II**

3. (a) Evaluate  $\iint_A xy \, dx \, dy$ , where A is the domain bounded by x-axis, ordinate  $x = 2a$  and the curve  $x^2 = 4ay$ .

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**P. T. O.**

(b) Evaluate  $\int_0^{\infty} \int_x^{\infty} \frac{e^{-y}}{y} dx dy$  by changing the order of integration.

4. (a) Find the area between the parabolas  $y^2 = 4ax$  and  $x^2 = 4ay$ .
- (b) Calculate the volume of the solid bounded by the surfaces  $x = 0$ ,  $y = 0$ ,  $z = 0$  and  $x + y + z = 1$ .

### UNIT-III

5. (a) Find the directional derivative of  $\Phi = (x^2 + y^2 + z^2)^{\frac{-1}{2}}$  at the point  $P(3, 1, 2)$  in the direction of the vector  $yz \hat{i} + xz \hat{j} + xy \hat{k}$ .

(b) State and prove the physical meaning of Curl.

6. (a) Compute  $\int_C \vec{F} \cdot d\vec{r}$ , where  $\vec{F} = \frac{y \hat{i} - x \hat{j}}{x^2 + y^2}$  and  $C$  is the circle  $x^2 + y^2 = 1$  traversed counter clockwise.

(b) Apply Green's theorem to evaluate :

$\oint_C [(2x^2 - y^2)dx + (x^2 + y^2)dy]$ , where  $C$  is the boundary of the area enclosed by the x-axis and the upper half of circle  $x^2 + y^2 = a^2$ .

### UNIT-IV

7. (a) Find an analytic function  $f(z)$  whose real part is  $2x(1 - y)$ .

(b) Find the Laurent's series which represent the function :

$$f(z) = \frac{(z^2 - 1)}{(z+2)(z+3)}, \text{ when}$$

(i)  $2 < |z| < 3$

(ii)  $|z| > 3$ .

8. (a) Define Cauchy's integral formula and hence evaluate :

$$\oint_C \frac{z^2 + 1}{z^2 - 1} dz, \text{ where } C \text{ is the circle } |z| = \frac{3}{2}.$$

(b) Find the sum of the residues of the function :

$$f(z) = \frac{\sin z}{z \cos z} \text{ at its poles inside the circle } |z| = 2.$$