

Roll No.

Total Pages : 2

BT-2/M-26

42033

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 different types of Bravais Lattices in 3 dimension. 10
(b) Draw neat and clean diagram of BCC structures, Calculate its packing fraction also. 5
2. (a) Derive an expression for concentration of Schottky defects in a Crystal. 10
(b) What are Miller indices? Explain how they are obtained. Draw planes $(0\ 0\ 1)$, $(1\ 1\ 0)$? 5

UNIT-II

3. (a) Show that the group velocity associated with the wave packet is equal to the velocity of the particle. 5

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P. T. O.

- (b) Derive time dependent Schrödinger wave equation for a non relativistic particle. 10
4. (a) Explain uncertainty principle and give it's one important applications. 10
- (b) How will you explain the need and origin of Quantum mechanics ? 5

UNIT-III

5. (a) Discuss Drude and Lorentz model with its main assumptions. 10
- (b) Give Fermi Dirac distribution function. 5
6. (a) Write note on Brillouin zones. 5
- (b) What is Hall Effect? Give its some applications. 10

UNIT-IV

7. (a) What do you mean by extrinsic semiconductor ? Derive an expression for carrier concentration in extrinsic semiconductor. 8
- (b) Describe the formation of p-n junction. Discuss its current voltage characteristic. 7
8. (a) Discuss Bipolar junction transistor with it's characteristics. 7
- (b) Explain the working and characteristics of Field Effect Transistor (FET). 8

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Total Pages : 3

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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) Explain the π -molecular orbitals of Benzene. 5
(b) Write down the main postulates of Molecular Orbital Theory (M.O.T.). Also specify the characteristics of Bonding Molecular Orbitals. 5
(c) Explain the Energy Level diagram of $[\text{Ni}(\text{CO})_4]$. 5
2. (a) Draw energy level diagram for Nitrogen molecule. Also comment on its Magnetic nature. 5
(b) Describe Magnetic properties of complexes. 6
(c) Define CFSE. How will you calculate the CFSE for Octahedral and Tetrahedral complexes ? 4

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P. T. O.

UNIT-II

3. (a) Explain the Fundamental modes of vibrations in IR Spectroscopy. 5
- (b) Describe selection rules applicable for different types of Spectroscopy. 5
- (c) What do you understand by Red Shift and Blue Shift ? 5
4. (a) Define the term Spectroscopy. Explain the basic principle of UV Spectroscopy. 5
- (b) Differentiate between Phosphorescence and Fluorescence. 5
- (c) Discuss about Diffraction and Scattering. Also mention their applications. 5

UNIT-III

5. (a) How will you calculate entropy change in case of an ideal gas when temperature and pressure varies ? 5
- (b) Derive Gibb's Helmholtz equation (modified form). 5
- (c) Define free energy and write down its Physical significance. 5

6. (a) Write a note on Hard-Soft/Acid-Base concept. 5
- (b) Define term Ionisation Energy. Describe the factors affecting Ionisation Energy. 5
- (c) Derive Nernst equation. Give its significance also. 5

UNIT-IV

7. (a) Describe the Synthesis of Paracetamol drug molecule (Mechanism also). 5
- (b) Define alpha and beta elimination. Differentiate E_1 and E_2 mechanisms with suitable examples. 7
- (c) Define Oxidation reaction mention at least two examples. 3
8. (a) Define the term Isomer. Explain the different types of structural isomers with example. 8
- (b) Define Ring Opening reactions mention at least two examples. 3
- (c) Differentiate between Enantiomers and Diastereomers. 4

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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) Define algorithm and flowchart. Write an algorithm to check whether number is prime or not. 8
- (b) Draw and explain flowchart for finding largest of three numbers. 7
2. (a) Convert the following : 9
 - (i) $(7543.21)_8 = (?)_{10}$
 - (ii) $(9AF.4)_{16} = (?)_2$
 - (iii) Perform binary subtraction : $(1010)_2 - (0011)_2$.
- (b) What is Primary memory? discuss its different types. 6

UNIT-II

3. (a) Explain different types of Operators in C with examples. 7
- (b) Write a C program to check whether a number is palindrome or not. 8
4. (a) Explain control statements in C with syntax. 8
- (b) Write a C program to print Fibonacci series using loop. 7

UNIT-III

5. (a) Write a C program to find largest element in array. 7
- (b) Write a C program to reverse a string. 8
6. (a) Write a C program to print factorial of a number using recursion. 7
- (b) Difference between call by Value and Call by reference. 8

UNIT-IV

7. (a) Define structure. Explain how structures are passed to functions with example? 7
- (b) Write a C program to swap two numbers using pointers. 8

8. (a) Explain dynamic memory allocation functions (malloc, calloc, free). 8
- (b) Write a C program to write and read data from a file. 7

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42036

ENGLISH

Paper-HM-101A

Time Allowed : 3 Hours]

[Maximum Marks : 75

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

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

Glory, Pride, jest, doubt, riddle, fretted, forbade,
glimpses, bare.

- (b) Write one appropriate antonym for the following words
given (any **seven**) : 7×1=7

rough, give, short, decline, heaven, day, fair, external.

2. Form two suitable words from the following prefix and
suffix given : 15

(i) Multi (ii) mis

(iii) re (iv) un

(v) mal (vi) non

- (vii) a (viii) dis
- (ix) able (x) en
- (xi)er (xii) ful
- (xiii) ic (xiv) ious
- (xv) ed.

3. (a) Make sentences using the following proverbs :

8×1=8

- (i) Where there's a will, there's a way.
- (ii) A rolling stone gathers no moss.
- (iii) A stitch in time saves nine.
- (iv) Beauty is in the eye of the beholder.
- (v) The Forbidden fruit is always the sweetest.
- (vi) Curiosity killed the cat.
- (vii) It's no use crying over spilled milk.
- (viii) Many hands make light work.

(b) Punctuate the following sentences :

7×1=7

- (i) I have just one word to say to you said the dealer.

- (ii) Joe has pens, pencils, paper and books.
 - (iii) The priest said god loves all.
 - (iv) You will have to improve remarked the teachers.
 - (v) No my school has not closed.
 - (vi) What is your name.
 - (vii) She is Lovely is not she.
4. What are the techniques for writing precisely? Define and explain these writing techniques with examples. 15
5. (a) Fill in the blanks with most appropriate word given in the parenthesis : 5×1=5
- (i) Sheela decided to the job offer after careful thought. (accept / except)
 - (ii) The heavy rain had a major on the traffic. (effect / affect)
 - (iii) Please ensure you your notebook to class tomorrow. (bring / take)
 - (iv) The teacher asked the students to be during the test. (quite / quiet)
 - (v) He is the of our school. (principal /principle)

- (b) Fill in the blanks in the following sentences with appropriate forms of the verb given in the brackets : 10×1=10

(i) Abdul to be a doctor.

(wants, wanting, is wanting)

(ii) The soup good. (taste, tastes, is tasting)

(iii) He TV most evening.

(watches, is watch, is watching)

(iv) He..... out five minutes ago.

(has gone, had gone, went)

(v) When he lived in Hyderabad, he
to the cinema once a week.

(goes, went, was going)

(vi) The baby all morning.

(cries, has been crying)

(vii) I Rahim at the zoo.

(Saw, have seen, had seen)

(viii) I Kumar this week.

(haven't seen, didn't see, am not seeing)

(ix) This paper twice weekly.

(is appearing, appearing, appears)

- (x) Ashok fell off the ladder when he
the roof. (is mending, was mending, mended)

6. Correct the following sentences : $15 \times 1 = 15$

- (i) Ram went to school despite of having a fever.
- (ii) I haven't seen Susan since six years.
- (iii) Sita is busy at the work, so she can't make it on time.
- (iv) Our mathematics teacher is giving us too much tasks.
- (v) Do not advice her, she won't listen.
- (vi) My mother cooks rice yesterday.
- (vii) He or Raju are guilty.
- (viii) Sohan is brave than his friends.
- (ix) The mans purse was lost in the bus.
- (x) The boy studied when his father came home from work?
- (xi) Do he have any idea where he is going?
- (xii) Have you ever being to Kerala?
- (xiii) They has a party planned for Amy.

- (xiv) The shepherd took his sheeps to the field.
- (xv) I prefer chocolate milkshake than vanilla ice cream.
7. Write an essay on any **one** of the following topics given : (500 words). 15
- (a) When You're the Boss--and the Intern : Staying Sane While Self-Employed.
- (b) Climate Change: the Biggest Threat to Humanity.
- (c) The prose and cons of using AI in Human life.
8. Can you test coherence by reading just the introduction and conclusion in Nature and style of sensible writing - do they match? How do you keep the conclusion concise but still resonant? 15

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42037

PROBABILITY & 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

1. (a) Two dice are tossed once. Find the probability of getting an even number on the first die or a total of 8.
- (b) A can hit a target 3 times in 5 shots, B can hit 2 times in 5 shots and C can hit 3 times in 4 shots. They fire a volley. What is the probability that :
 - (i) Two shots hit.
 - (ii) At least two shots hit?
2. (a) A random variable X has the following probability function :

x	0	1	2	3	4	5	6	7
$P(x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

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P. T. O.

(i) Find the value of k .

(ii) Evaluate $P(X < 6), P(X \geq 6)$.

(b) The frequency distribution of a measurable characteristic varying between 0 and 2 is as under :

$$f(x) = \begin{cases} x^3, & 0 \leq x \leq 1 \\ (2-x)^3 & 1 \leq x \leq 2. \end{cases}$$

Calculate the standard deviation and also the mean deviation about the mean.

UNIT-II

3. (a) A variate X has the probability distribution :

x	-3	6	9
$P(X = x)$	1/6	1/2	1/3

Find $E(X)$ and $E(X^2)$. Hence evaluate $E(2X+1)^2$.

(b) The frequency function of a continuous random variable is given by :

$$f(x) = y_0 x(2-x), 0 \leq x \leq 2.$$

Find the value of y_0 , mean and variance of x .

4. (a) A die is thrown 4 times. Getting a number greater than 2 is a success. Find the probability of :

- (i) Exactly 1 success.
- (ii) Less than 3 successes.
- (iii) More than 3 successes.
- (b) A manufacturer of pins knows that on an average 5% of his product is defective. He sells pins in a packet of 100 and guarantees that not more than 4 pins will be defective. What is the probability that :
- (i) A packet will meet the guaranteed quality.
- (ii) A packet will fail to meet the guaranteed quality
(Given $e^{-5} = 0.0067$).

UNIT-III

5. (a) Calculate the mode from the following data :

<i>Class Interval</i>	0-5	5-10	10-15	15-20	20-25	25-30	30-35
<i>Frequency</i>	1	2	10	4	10	9	2

- (b) Calculate mean deviation for the following data :

<i>Marks</i>	0-10	10-20	20-30	30-40	40-50
<i>No. of Students</i>	6	28	51	11	4

6. (a) Find out the coefficient of correlation between X and Y by the method of rank differences :

X	15	17	14	13	11	12	16	18	10	9
Y	18	12	4	6	7	9	3	10	2	5

- (b) From the following data obtain two regression equations :

X	1	2	3	4	5
Y	2	5	3	8	7

UNIT-IV

7. (a) Fit a straight line to the following data by the method of least square :

X	1	3	4	6	8	9	11	14
Y	1	2	4	4	5	7	8	9

- (b) Fit a second degree parabola to the following data :

X	0	1	2	3	4
Y	1	5	10	22	38

8. A packet consists of 100 ball pens. The distribution of the number of defective ball pens in each packet is given below :

X	0	1	2	3	4	5
f	61	14	10	7	5	3

Examine whether Poisson distribution is appropriate for the above data at 5% level of significance.

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42038

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 circle of diameter 50 mm rolls on a straight line without slipping. Trace the locus of a point on the circumference of the circle rolling for one complete revolution. Name the curve, draw the tangent and normal at any point on the curve. 15
2. Construct a diagonal scale of 1:25 to read meters, decimeters and centimeters and long enough to measure 4 m. mark on it a distance of 2.47 m. 15

UNIT-II

3. A line AB measuring 70 mm has its end A 15 mm in front of VP and 20 mm above HP and the other end B 60 mm in front of VP and 50 mm above HP. Draw the

projections of the line and find the inclinations of the line with the both the reference planes of projection.

15

4. A cone of base 80 mm diameter and height 100 mm lies with one of its generators on HP and the axis appears to be inclined to VP at an angle of 40° in the top view. Draw its top and front views. 15

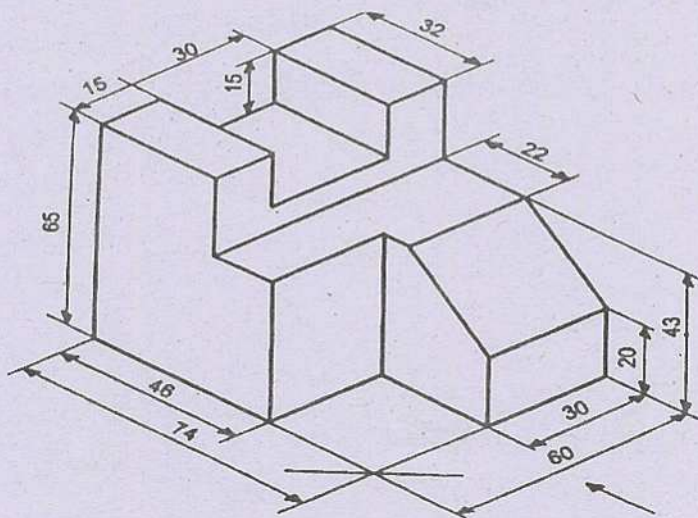
UNIT-III

5. A cylinder of diameter 40 mm and height 50 mm rests on its base on the HP. It is cut by a plane perpendicular to the VP and inclined at 50° to the HP. The cutting plane meets the axis at a distance of 15 mm from the top. Draw the front view, sectional top view and the true shape of the section. 15
6. A pentagonal prism, side of base 25 mm and altitude 50 mm, rests on its base on the HP such that an edge of the base is parallel to VP and nearer to the observer. It is cut by a plane inclined at 45° to HP, perpendicular to VP and passing through the center of the axis. 15

UNIT-IV

7. Draw the isometric projection of a sphere of diameter 48 mm which is placed centrally on the top face of a conical frustum. The base diameter of the frustum is 60 mm, top face diameter 48 mm and height 40 mm. 15

8. Draw the front, top and right-hand side view of the figure given below : 15



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42039

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. Construct a diagonal scale of R.F. = $1/6250$ to read upto 1 kilometre and to read metres on it. Show a length of 653 metres on it. 15
2. A thin circular disc of 50 mm diameter is allowed to roll without slipping from upper edge of sloping plank which is inclined at 15° with the horizontal plane. Draw the curve traced by the point on the circumference of the disc. 15

UNIT-II

3. The ends of a line PQ are on the same projector. The end P is 30 mm below the H.P. and 12 mm behind the V.P. The end Q is 55 mm above the H.P. and 45 mm in front of the V.P. Determine the true length and traces of PQ and its inclinations with the two planes. 15

4. Draw the projections of a cone, base 45 mm diameter and axis 50 mm long, when it is resting on the ground on a point on its base circle with (a) the axis making an angle of 30° with the H.P. and 45° with the V.P.; (b) the axis making an angle of 30° with the H.P. and its top view making 45° with the V.P. 15

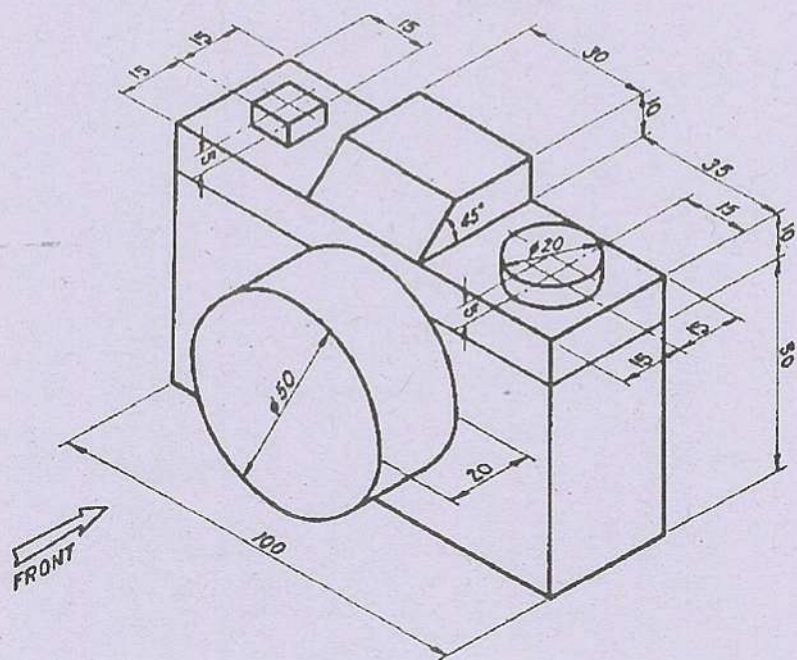
UNIT-III

5. A hexagonal prism, has a face on the H.P. and the axis parallel to the V.P. It is cut by a vertical section plane, the H. T. of which makes an angle of 45° with xy and which cuts the axis at a point 20 mm from one of its ends. Draw its sectional front view and the true shape of the section. Side of base 25 mm long; height 65 mm. 15
6. A square pyramid, base 40 mm side and axis 65 mm long, has its base on the H.P. and all the edges of the base equally inclined to the V.P. It is cut by a section plane, perpendicular to the V.P., inclined at 45° to the H.P. and bisecting the axis. 15

UNIT-IV

7. Draw the isometric view of a square-headed bolt 24 mm diameter and 70 mm long, with a square neck 18 mm thick and a head, 40 mm square and 18 mm thick. 15

8. Draw any two Orthographic views of given views : 15



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Total Pages : 2

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42040

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. Describe in detail the Prokaryotic cell structure with the help of well-labelled diagram. 15
2. Write short notes on the following : 15
 - (a) Cell theory.
 - (b) Homeostasis.
 - (c) Flow of genetic information.

UNIT-II

3. What are Restriction enzymes? Describe the mechanism of action and applications of Restriction enzymes in recombinant DNA Technology. 15
4. Write short notes on the following : 15
 - (a) Photosynthesis-Mechanism.

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- (b) Nucleoside Monophosphate Kinases and its applications.

UNIT-III

5. Define, classify and list the important functions of Proteins in living organisms. 15
6. Write short notes on the following : 15
- (a) Classification and functions of Carbohydrates.
- (b) Differentiate between DNA and RNA.

UNIT-IV

7. What is a Biosensor? Discuss various types and applications of Biosensors. 15
8. Write short notes on the following : 15
- (a) Role of Biology in Bioinformatics.
- (b) Role of Biology in nanotechnology.

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42041

BASIC ELECTRICAL ENGINEERING

Paper-ES-101A

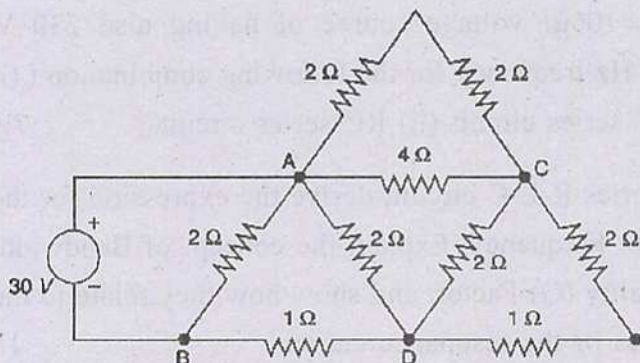
Time Allowed : 3 Hours]

[Maximum Marks : 75

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

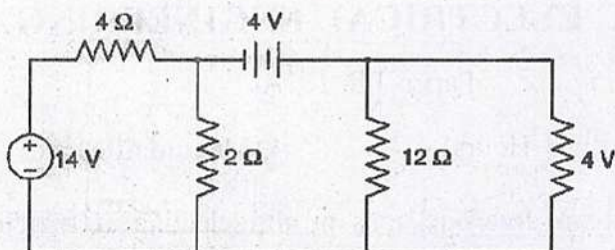
UNIT-I

1. (a) Define and classify circuit elements with one example each : Linear vs. Non-linear, Active vs. Passive and Unilateral vs. Bilateral. 7½
- (b) Find out the current delivered by the source in the given circuit. 7½



2. Find out the voltage drop across 12Ω resistance using Norton's theorem for the circuit shown in Figure. Draw the Thevenin's and Norton's equivalent circuit also.

15



UNIT-II

3. (a) Define and explain the physical significance of Active, Reactive, and Apparent Power. Derive the expression for instantaneous power in a purely inductive circuit and show that the average power over a full cycle is zero. 7½
- (b) Find out the impedance, current and power factor for circuit having $R=12\Omega$, $L=20mH$ and $C=100\mu F$ voltage source of having also 230 V, 50 Hz frequency for the following combination : (i) RL series circuit (ii) RC series circuit. 7½
4. For a series R-L-C circuit, derive the expression for the Resonant Frequency. Explain the concept of Bandwidth and Quality (Q) Factor, and show how they relate to the sharpness of the resonance curve. 15

UNIT-III

5. Prove that in a balanced Delta connection, the Line Current is times the Phase Current. Also, why is the Two-Wattmeter Method preferred for measuring 3-phase power? 15
6. Explain the principle and construction of a Single-Phase Transformer. Derive the EMF Equation and explain why a transformer cannot operate on a DC supply? 15

UNIT-IV

7. (a) What do you mean by DC machine? Explain its construction with neat and clean diagrams. $7\frac{1}{2}$
- (b) Define the term commutator. How it behaves, when the DC machine operates as motor and generator? $7\frac{1}{2}$
8. (a) Why is a single-phase induction motor not self-starting? Write short note on Capacitor-start, Capacitor-run motor. $7\frac{1}{2}$
- (b) What is the need of Earthing? Explain the various types of Earthing in brief. $7\frac{1}{2}$

BT-2/M-26

42042

INTRODUCTION TO ELECTROMAGNETIC THEORY

Paper-ES-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. (a) Explain divergence and curl of an Electric field. 8
- (b) Find the Electric field for infinitely long straight line charge using Gauss's law. 7
2. (a) Derive relation for energy density in a region of a uniform electric field E . 8
- (b) Explain potential of a localized charge distribution. 7

UNIT-II

3. (a) State and prove Gauss's law in the presence of dielectrics. 8

- (b) Explain forces in dielectrics. 7
4. (a) Define Polarization. How a dielectric acquires Polarization ? 8
- (b) Discuss field of a polarized object. 7

UNIT-III

5. (a) Discuss bound currents and its Physical significance. 8
- (b) Explain Ampere's law in Magnetized material. 7
6. (a) Explain concept of Vector Magnetic Potential. Why it is Vector quantity? 8
- (b) Discuss the effect of magnetic field on Atomic orbit. 7

UNIT-IV

7. Write Maxwell's equations in point form and derive them. 15
8. (a) Write Maxwell's equation in integral form and give their physical significance.. 8
- (b) Derive equation for the propagation of plane electromagnetic wave in linear media. 7

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Total Pages : 3

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42043

CALCULUS & 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 : $x \frac{dy}{dx} + y = x^3 y^6$. 8

(b) Solve : $\frac{dy}{dx} = \frac{x^3 + y^3}{xy^2} = 0$. 7

2. (a) Solve : $\frac{d^2 y}{dx^2} - \frac{dy}{dx} + 4y = e^{2x}$. 8

(b) Solve the method of variation of parameters : 7

$$\frac{d^2 y}{dx^2} + y = \operatorname{cosec} x.$$

UNIT-II

3. (a) Find, by double integration, the area lying between the parabola :

$$y = x^2 \text{ and the line } y = 2x + 3.$$

- (b) Change the order of integration in the integral : 7

$$\int_{-a}^a \int_0^{\sqrt{a^2 - y^2}} f(x, y) dx dy.$$

4. (a) Evaluate $\int_0^a \int_0^b \int_0^c (x^2 + y^2 + z^2) dx dy dz.$ 8

- (b) Find, by triple integration, the volume of the sphere $x^2 + y^2 + z^2 = a^2.$ 7

UNIT-III

5. (a) Find the directional derivative of $f(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the vector $\hat{i} + 2\hat{j} + 2\hat{k}.$ 8

- (b) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $r \neq 0$, show that : 7

$$\nabla(r^n) = n r^{n-2} \vec{r}$$

6. (a) Evaluate the line integral $\int (x^2 + xy) dx + (x^2 + y^2) dy,$ along C, Where C the square formed by the lines $y = \pm 2$ & $x = \pm 2.$ 8

- (b) Verify Green's theorem for $f(y^2 + xy)dx + (x^2)dy$,
along C, where C is bounded by $y = x$ and $y = x^2$.

7

UNIT-IV

7. (a) Determine the analytic function whose real part is :

8

$$\frac{y}{x^2 + y^2}.$$

- (b) If $f(z)$ is an analytic function with constant modulus, show that $f(z)$ is constant.

7

8. (a) Evaluate, using Cauchy integral formula :

8

$$\oint \frac{e^{2z}}{(z+i)^4} dz, \text{ around the circle } |z|=3.$$

- (b) Find the sum of the residues of $f(z) = \frac{e^z}{\cos \pi z}$ at its pole inside the unit circle $|z|=1$.

7