Time: 2 hours   **Max. Marks 60**

N.B. 1. Question No.1 is compulsory.
   2. Attempt any three from Q.2 to Q.6
   3. Draw a neat diagram and write chemical reactions where necessary.
   4. Figures to the right indicate full marks.
   5. Atomic weights: H = 1, C = 12, N = 14, O = 16.

Q.1 **Answer any five from the following.**   **(15 Marks)**

a Explain why gold, silver, platinum do not undergo corrosion.

b A coal sample was subjected to ultimate analysis.1.5 g of coal sample on combustion in bomb calorimeter produced 0.24g of $BaSO_4$.Calculate the % of sulphur.

c Explain the principle "prevention of wastes" of green chemistry.

d Define spectroscopy and give any two differences between absorption and emission spectra.

e What is knocking? What are the effects of knocking of gasoline?

f Calculate the standard emf of a cell reaction at 25^0C ,
$Cr(s)|Cr^{3+}_{(1M)}||Co^{2+}_{(1M)}|Co(s)$
$E^{o}Co = - 0.280V,\quad E^{o}Cr = -0.74V$

g Distinguish between galvanizing and tinning.

Q.2 a Define corrosion? Explain the mechanism of corrosion by absorption of oxygen with diagram and reactions.   **6**

b What is green fuel? Give the preparation method of bio-diesel and also mention its advantages.   **5**

c   Write a note on oxygenates and role of catalytic converter.   **4**

Q.3 a How do the following factors affect the rate of corrosion: **6**
(i) Relative areas of anodic to cathodic part.
(ii)Position of metal in galvanic series.
(iii)Purity of metal.

b Calculate higher and lower calorific value of coal sample containing C-80%, O-3%, H-7%, S-3.5%, N=2.1% and the remaining is ash.   **5**

c Differentiate between Electrolytic and Galvanic cell.   **4**

Q.4 **a** Calculate the volume and weight of air required for complete combustion of $1m^3$ of gaseous fuel having the following composition: CO = 10%, C_3H_8 = 12%, CH_4 =30%, N_2 = 3 %, H_2 = 40%, CO_2 = 3%, O_2 = 2.0% (Molecular weight of air =28.949). **6**

b Write a traditional and greener pathway for the synthesis of carbaryl. Write the name of the principle associated with this synthesis. **5**

c What is the selection rule? Explain any two Selection rules. **4**

Q.5 **a** Define spectroscopy and electromagnetic spectrum show the various regions of electromagnetic spectrum with the help of diagram. **6**

b Calculate the percentage atom economy for the following reaction with respect to acetanilide. **5**

$C_6H_5NH_2 + (CH_3CO)_2O \longrightarrow C_6H_5NHCOCH_3 + CH_3COOH$

Given Atomic Weights: C = 12, H = 1, O = 16, N = 14

c Explain impressed current cathodic protection of corrosion control. **4**

Q.6 **a** What is an electrochemical cell? Give construction and working of any one reference electrode with the help of diagram and reactions. **6**

b Define Octane and Cetane number. 2.4999 g of coal sample was taken in a silica crucible and heated in an oven maintained at 110^0C for one hour. The weight after heating was 2.368g. Calculate the percentage moisture content in the coal. **5**

c Explain mechanism of electrochemical corrosion by the evolution of hydrogen with the help of a diagram. **4**

****

Duration: 2 hour   **Total Marks: 40**

NB: *Q1. is compulsory.*
        Attempt any Three out of the remaining Five questions.
        Figures to the right indicate full marks.
        Answers to the sub questions should be grouped together.

===

Q1. A.   Answer the following questions briefly.   **(05)**

 "Communication is a network of interactions where the sender and the receiver keep on changing their roles". Explain the process of Communication in the light of the above statement with the help of appropriate diagram.

B. Explain any 5C's of correspondence?   **(05)**

Q2. A. Being the Sales Manager of Universal Computer Technologies, Mumbai; you have received an annoyed letter from one of your wholesale distributors about the manufacturing defect in the batteries of the laptops that they have bought from your company recently. Draft a suitable reply using Complete block form**.**   **(05)**

B. Identify the sender, receiver, message, channel and feedback: **(05)**
        (i)Seeking vote during election campaign.

        (ii)The teacher summons the student to her cabin to give him some instructions. The student replies in the affirmative and leaves the cabin.

Q3. A. What is Hazard Notation and discuss how it can be categorized into various special notices?   **(05)**

B. Do as directed: **(05)**
1) It is 2 o'clock _____ my watch. (Use Preposition)
2) My uncle and aunt ___ visting me. (Use proper Subject verb agreement)
3) Use the synonym word to form two different sentences. Eminent, Imminent
4) Antonyms of : Pessimistic
5) One word substitution: Exchange of thoughts between two individuals

Q4. A. Write a letter to your college authorities requesting for Scholarship approval for paying your college fees.   **(05)**

B. **State whether the following statements are true or false.** (05)

(1)The living nature of the English language causes semantic barriers.

(2) Stage-fright is a very rare phenomenon.

(3)Crossing one's arms across one's chest is a sign of defensiveness.

(4) The first component in the process of communication is encoding.

(5) One should write to impress, not express.

(6)Written communication has legal validity.

(7)It is easier to change an opinion than to change a belief.

(8)Television is an example of a medium of communication.

(9)Pacing up and down the stage while speaking in public makes a good impression.

(10) One cannot not communicate.

Q5. A

Describe the following process through a definition, diagram, component, working and uses.

Electrolysis   OR   Titration (05)

    B.   Write short note on: (05)
    i)   Physical barrier
    ii)   Grapevine communication

Q6 A.

  Read the following passage and choose the right answer from the multiple choices given: (05)

 Many great inventions are initially greeted with ridicule and disbelief. The invention of the airplane was no exception. Although many people who heard about the first powered flight on December 17, 1903 were excited and impressed, others reacted with peals of laughter. The idea of flying an aircraft was repulsive to some people. Such people called Wilbur and Orville Wright, the inventors of the first flying machine, impulsive fools. Negative reactions, however, did not stop the Wrights. Impelled by their desire to succeed, they continued their experiments in aviation.

Orville and Wilbur Wright had always had a compelling interest in aeronautics and mechanics. As young boys; they earned money by making and selling kites and mechanical toys. Later, they designed a newspaper-folding machine, built a printing press, and operated a bicycle-repair shop. In 1896, when they read about the death of Otto Lilienthal, the brothers' interest in flight grew into a compulsion.

 Lilienthal, a pioneer in hang-gliding, had controlled his gliders by shifting his body in the desired direction. This idea was repellent to the Wright

brothers, however, and they searched for more efficient methods to control the balance of airborne vehicles. In 1900 and 1901, the Wrights tested numerous gliders and developed control techniques. The brothers' inability to obtain enough lift power for the gliders almost led them to abandon their efforts.

After further study, the Wright brothers concluded that the published tables of air pressure on curved surfaces must be wrong. They set up a wind tunnel and began a series of experiments with model wings. Because of their efforts, the old tables were repealed in time...and replaced by the first reliable figures for air pressure on curved surfaces. This work, in turn, made it possible for the brothers to design a machine that would fly. In 1903, the Wrights built their first airplane, which cost less than $1,000. They even designed and built their own source of propulsion lightweight gasoline engine. When they started the engine on December 17, the airplane pulsated wildly before taking off the plane managed to stay aloft for 12 seconds, however, and it flew 120 feet.

By 1905, the Wrights had perfected the first airplane that could turn, circle, and remain airborne for half an hour at a time. Others had flown in balloons and hang gliders, but the Wright brothers were the first to build a full-size machine that could fly under its own power. As the contributors of one of the most outstanding engineering achievements in history, the Wright brothers are accurately called the fathers of aviation.

(i) The idea of flying an aircraft was ----- to some people.
   (a) Boring
   (b) Distasteful
   (c) Exciting
   (d) Needless

(ii) People thought that the Wright brothers had ------.
   (a) Acted without thinking
   (b) Been negatively influenced
   (c) Been too cautious
   (d) Been mistaken
   (e) Acted in a negative way

(iii) The Wright's interest in flight grew into a -----.
   (a) Financial empire
   (b) Plan
   (c) Need to act
   (d) Foolish thought

(iv) Lilienthal's idea about controlling airborne vehicles was------ the Wrights.
   (a) Proven wrong by
   (b) Opposite to the ideas of
   (c) Disliked by
   (d) Accepted by
   (e) Improved by

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(v) The Wrights designed and built their own source of -------.
    {a) Force for moving forward
    (b) Force for turning around
    (c) Turning
    (d) Force for going backward

B. **Given below are certain instructions. Classify them into Caution, Warning, Instructions, Description, Maintenance and Definition.**

(05)

(i) A doorbell consists of a push-button switch, a signal unit, wiring, and a transformer.

(ii) Twice a year, wipe the blades of the ceiling fan with a damp cloth.

(iii) Unplug a refrigerator before servicing it.

(iv) Do not overload a circuit. It may result in fuse-blowing.

(v) When you chisel, cut away from your body, not towards yourself.

****

Time: 3 Hrs **Max Marks: 60**

Note :
- Solve any **FOUR** questions.
- All dimensions are in **mm**.
- Use First Angle Method Of Projection.
- Assume Suitable Dimension If Necessary.

Q.1 Following figure shows the pictorial view of an object. Draw
      i)   Sectional FV along section A-A **[5]**
      ii)   Top view. **[4]**
      iii)   Leftt Hand Side view **[4]**
      iv)   Insert at least 10 dimensions **[2]**

Q.2 (a) A cylinder of diameter 50mm and axis 65 mm long is resting on V.P on a point on the base circle with axis inclined at 45° to V.P and parallel to HP. Draw the projections of cylinder. **[6]**

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(b) Draw the isometric view of the object whose FV and TV are as given below. **[9]**

Q.3 (a) The pictorial view of a machine part is shown in following figure.
Draw
   i) Front view from the direction "X" **[4]**
   ii) Top view **[4]**
   iii) Insert at least 6 Dimensions. **[1]**

(b) Draw a hexagon ABCDEF of 25 mm sides with two of its sides AB & DE being vertical. One end of an inelastic string is attached at corner C of the hexagon and wound around its perimeter completely by holding the free end of the string such that the string is always tightly stretched. Trace the path of the free end. Name the curve. **[6]**

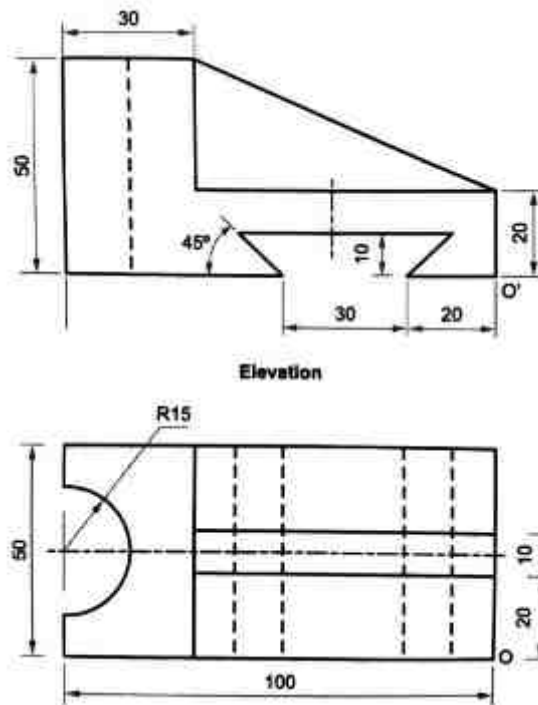**41524**   **Page 2 of 3**

Q.4   A hexagonal pyramid of base side 30 mm and axis 60 mm, has an edge of its **[15]** base on the HP inclined at 45° to the V.P. Draw the projections of the pyramid when the axis is inclined at 30° to the H.P.

Q.5   Draw the projections of a line AB when its end A is 20 mm above H.P. and 10 **[15]** mm in front of the V.P., its end B is 55 mm above the H.P. and 60 mm in front of the V.P. The distance between end projectors of line AB is 45 mm. Determine its true length, and inclination of line with the H.P. and V.P.

Q.6 (a) The FV and TV of an object is shown below. Draw the Isometric view of the **[8]** object.

Elevation

(b) A pentagonal prism of side of base 35 mm and axis 65mm long is resting on **[7]** one of its base edges on VP such that the base of the prism is inclined 45 degrees to VP and axis parallel to HP.Draw the projections of prism.

_____

(Time: 3 hours)   **Max Marks: 80**

Note: (1) Question No. 1 is Compulsory.

      (2) Answer any three questions from Q.2 to Q.6.

      (3) Figures to the right indicate full marks.

Q1.

a)   Solve $(2x^2 + 3y^2 - 7)x\,dx + (3x^2 + 2y^2 - 8)y\,dy = 0$ **5**

b)   Solve $(D^2 - 4D + 4)y = e^{2x} + cos3x$, where $D \equiv \frac{d}{dx}$ **5**

c)   Evaluate $\int_0^\infty x^3\,e^{-4x^2}\,dx$ **5**

d)   Change the order of integration $I = \int_0^a \int_{-a+\sqrt{a^2-y^2}}^{a+\sqrt{a^2-y^2}} f(x,y)\,dx\,dy$ **5**

Q2.

a)   Evaluate $I = \int \int \int \frac{z^2 dxdydz}{x^2 + y^2 + z^2}$ over the volume of the sphere   **6**

       $x^2 + y^2 + z^2 = 2$

b)   Find the length of the cardioid $r = a(1 + \cos\theta)$ which lies outside the   **6**
    circle $r + a\cos\theta = 0$

c)   Solve $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$ by using the method of Variation of parameters.   **8**

Q3.

a)   Prove that $\int_0^\infty \frac{1-cosax}{x}\,e^{-x}\,dx = \frac{1}{2}\log(1 + a^2)$, assuming the validity of   **6**
    differentiation under the integral sign.

b)   **6**

    Evaluate $I = \int \int y\,dx\,dy$ over the area bounded by

    $x = 0, y = x^2, x + y = 2$ in the first quadrant.

c)   Evaluate the integral   **8**

    $I = \int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{1}{\sqrt{1-x^2-y^2-z^2}}\,dx\,dy\,dz.$

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Q4.

a) Solve $\cos x \frac{dy}{dx} + y \sin x = \sec^2 x$ **6**

b) Solve $(D^2 + 3D + 2)y = e^{e^x}$ **6**

c) Prove that $\int_0^1 \frac{x^2 dx}{\sqrt{(1-x^4)}} \cdot \int_0^1 \frac{dx}{\sqrt{(1+x^4)}} = \frac{\pi}{4\sqrt{2}}$.   **8**

Q5.

a) Change the integral to polar coordinate and evaluate   **6**

$$I = \int_0^{2a} \int_0^{\sqrt{2ax-x^2}} (x^2 + y^2) dy dx$$

b) Find area of one loop of the lemniscate $r^2 = a^2 \cos 2\theta$ **6**

c) Solve $\frac{dx}{dy} - xy = x^3 y^3$ **8**

Q6.

a) Solve $(D^2 - 4)y = x \sinh x$ **6**

b) Solve $(y^4 + 2y)dx + (xy^3 + 2y^4 - 4x)dy = 0$ **6**

c) Change the order of integration and evaluate   **8**

$$I = \int_0^a \int_y^{\sqrt{ay}} \frac{x}{x^2+y^2} dx dy$$

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Duration: 2hr   **Marks: 60**

N.B.	1 Question No.1 is Compulsory
	2 Attempt any three questions from the remaining questions Nos.2 to 6
	3 Assume Suitable data wherever required.
	4 Figures to the right indicate marks.

Q1   **Attempt any five from the following (3 marks each)**   **15**

1(a)   How interference of light is produced by (i) division of wave front and (ii) division of amplitude

(b)   What is the difference between LASER and Ordinary Light?

(c)   Calculate V number for an optical fiber having numerical aperture 0.25 and core Diameter 20 micrometer if it is operated at 1.55 micrometer.

(d)   What is curl of vector? Explain its significance

(e)   What is CRO? Draw its block diagram

(f)   Enlist various properties of nanomaterial's

(g)   A grating has 620 rulings/mm and is 5.05mm wide. What is the smallest wavelength interval that can be resolved in the third order at λ=481nm?

Q2 A   Derive the conditions for maxima and minima due to interference in transmitted system of light from thin film of uniform thickness.   **08**

B   Derive the expression for numerical Aperture for a step index fiber. The N.A. of an optical fiber is 0.5 and core R.I. is 1.54. Find refractive index of cladding   **07**

Q3 A   With neat sketch explain principle, construction, working& energy diagram of He-Ne Laser   **08**

B   What is meant by diffraction & diffraction grating? How it is useful for determination of wavelength of monochromatic source?   **07**

Q4 A   Define a field. What are scalar and vector fields?

B   Explain the construction & working of CRO   **05**

C   Diameter of the 15th dark ring was 0.59 cm in a Newton's ring experiment. When a liquid is used in placed of air, the diameter of that ring is decreased by 0.09 cm. What is the refractive index of the liquid?   **05**

Q5 A   Explain the working of SEM with a neat diagram &its applications   **05**

B   Derive point form of all Maxwell's equations   **05**

C   An electron enters a uniform magnetic field (B) =0.23 wb/m2 at an angle 45^0 to B determine the radius and pitch of the helical path. Speed of electron is 3×10^7 m/s.   **05**

Q6 A   What is divergence of vector in Cartesian? Explain its significance.   **05**

B   What is pumping in LASE?Give the types of pumping   **05**

C   What do you understand by anti-reflection coating? Derive the conditions with proper diagram

                                                                                                              05

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Time: 2 Hours   **Maximum Marks: 60**

i	Question number 1 is compulsory
ii	Attempt any three questions from Q2 to Q6
iii	Assume suitable data wherever required
iv	Figures to the right indicate full marks for that question

QN	Question	Marks
Q1	**Attempt any five out of six (3 marks each)**	**15**
A	What do you mean by resolving power of diffraction grating ?What is it's significance ?	
B	What is population inversion in Laser system ? What is it's Significance ?	
C	An optical fibre refractive index 1.48 and 1.41 respectively of core ,clad Calculate i) Critical angle ii) Numerical Aperture iii) Maximum Incidence angle	
D	Find the divergence of a Vector field $\overrightarrow{F} = 4x\,\hat{\imath} + 2y\,\hat{\jmath} + 3z\,\hat{k}$	
E	Calculate the velocity of a particle at which it should move so that its mass will increase by 25% of its rest mass.	
F	What are nanomaterials & what are their different types	
Q2	**Attempt all questions**	**15**
A	What is plane transmission Grating ? Explain its spectral response A plane transmission Grating has 5000 lines/cm. i) Determine the Highest order of spectrum observed if incident light is having wavelength of 6010 Å°ii) If the opaque spaces between the slits are made three times the transparent space and the maximum order is three , Find which order of spectra will be absent .	**8**
B	With neat and labelled diagrams explain the construction and working of a Nd-Yag laser.	**7**

Q3   **Attempt all questions**   **15**

A   What are Galilean transformations? Obtain transformation equations for coordinate, velocity and acceleration.   **8**

B   Explain the term 'curl of a vector and state its significance'. Show that the divergence of the curl of a vector is zero.   **7**

Q4   **Attempt all three questions (5 marks each)**   **15**

A   What do you understand by resolving power? How can the resolving power of a grating be increased? Find maximum resolving power of a grating of width 3 cm, illuminated by a laser beam of wavelength 6000 Å° having 6000 lines per cm.

B   What is the divergence of a vector field? Find the divergence of a field $F = xz\,\hat{i} + y^2z^3\,\hat{j} - xyz\,k$ at a point $(3, -1, 2)$. Interpret the result you obtain.

C   With a neat labelled diagram explaining the construction and working of an Scanning electron microscope. (SEM)

Q5   **Attempt all three questions (5 marks each)**   **15**

A   Obtain Ampere's circuital law for static magnetic field in differential and integral form

B   What is time dilation? Express it mathematically. The length of a moving rod is found to be one fourth of its length when at rest. What is the speed of the rod relative to the observer?

C   What is Holography ? With neat diagram explain reconstruction process of a hologram.

Q6   **Attempt three questions (5 marks each)**   **15**

Write short Notes on

A   Application of fibre optics in communication

B   Applications of Nano technology in various fields

C   Applications of Lasers in industry

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Time: 2 hour   **Max. Marks: 60**
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NB: 1) Question No.1 is compulsory.
   2) Attempt any three questions from question no. 2 to 6.

Q1	**Solve any three out of the following.**	**15**
A	Define Flowchart? Explain different symbols used in drawing Flowchart.	**05**
B	Difference between while loop & do-while loop.	**05**
C	Explain Different data type modifiers available in C language.	**05**
D	Write a program to print the following pattern for number of rows given by the user.	**05**

     1
    21
   321
  4321

E	Write a program to display all prime numbers from 1 to 50.	**05**
Q2		**15**
A	Differentiate between break and continue.	**05**
B	Explain the following functions with proper example. i) pow( ) ii) ceil( ) iii) floor( )	**05**
C	Write a program to find value of y using recursive function , where $y = x^n$	**05**
Q3		**15**
A	Explain the sizeof( ) operator with proper example.	**05**
B	Write a program to find the factorial of a given number.	**05**
C	Write a program to store and display the name, roll no. and fees of 100 students using structure.	**05**
Q4		**15**
A	Write a short note on Structure.	**05**
B	Write a program to find the largest of 'n' numbers taken from user.	**05**
C	Explain conditional Operator with proper example.	**05**
Q5		**15**
A	Explain flowing functions with proper example. i) strcmp( ) ii) strcat ( ) iii) strlwr( )	**05**
B	Write a program to accept the elements of square matrix and to find sum of elements present on, above and below principal diagonal.	**05**
C	Write a program to find square root of a accepted perfect square integer number **without** using standard sqrt( ) function.	**05**
Q6		**15**
A	Write a program to add two numbers using user defined function.	**05**
B	Define array? Explain the static and dynamic initialization of 1D array.	**05**
C	Draw flowchart to find largest of Three numbers, accepted from user.	**05**

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