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

N.B. **(1) Question no.1 is compulsory.**
      (2) Use of statistical table is permitted.
      (3) Figures to the right indicate full marks.

Q1. A.   Solve $(D^3 - 2D^2 - 5D + 6)y = e^{3x} + 8$.   [5]

B.   Using Beta and Gamma function evaluate   [5]
$\int_0^2 x^2 (2 - x)^3 dx$.

C.   Express into polar form and evaluate the integral   [5]
$\int_0^a \int_0^{\sqrt{a^2 - x^2}} e^{-(x^2 + y^2)} \, dx \, dy$.

D.   Evaluate $\int_1^e \int_1^{\log y} \int_1^{e^x} \log z \, dz \, dx \, dy$.   [5]

Q2. A.   Using Beta function, Prove that $\int_0^\infty \frac{1}{1+x^2} dx = \frac{\pi}{2}$.   [6]

B.   Using the method of variation of parameters, solve   [6]
$\frac{d^2 y}{dx^2} + a^2 y = \sec ax$.

C.   Show that the area between the parabolas   [8]
$y^2 = 4ax \text{ and } x^2 = 4by \text{ is } \frac{16}{3} ab$.

Q3. A.   Solve $(D^3 - 2D^2 - 5D + 6)y = e^{3x} + 8$.   [6]

B.   Using Beta and Gamma function evaluate   [6]
$\int_0^2 x^2 (2 - x)^3 dx$.

C.   Change the order of integration for the integral and evaluate   [8]
$\int_0^\infty \int_0^x x e^{\frac{-x^2}{y}} dx dy$.

Q4. A.   Solve the differential equation $y \frac{dy}{dx} + \frac{4x}{3} - \frac{y^2}{3x} = 0$.   [6]

B.   Change to polar co-ordinates and evaluate   [6]
$\int_0^1 \int_0^x x + y \ dy dx$.

C.   Solve $(D^2 + 4)y = \cos 2x$.   [8]

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Q5. A. Solve $(D^2 - 2D + 1)y = e^x + 1$. [6]

B. Find the length of the cardioid $r = a\,(1 - cos\theta)$ lying outside the circle $r = a\,cos\theta$. [6]

C. Evaluate $\int_0^{\frac{\pi}{6}} cos^3 3\theta\, sin^2 6\theta\, d\theta$. [8]

Q6. A. Solve $\frac{dy}{dx} + \frac{y\,cosx + siny + y}{Sinx + x\,cosy + x} = 0$. [6]

B. Find the particular integral of $(D^2 - 4D + 4)y = e^x + cos2x$. [6]

C. Find the length of the arc of the curve $r = a\,sin^2\left(\frac{\theta}{2}\right)$ from $\theta = 0$ to any point $P(\theta)$. [8]

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(3 Hours)   **[Total Marks: 60]**

*N.B.-1. Question **No.1** is **compulsory.***
 *2. Attempt **any three** questions out of remaining **five** questions.*
 *3. Use **first angle method of projection**, unless mentioned otherwise.*
 4. Write all answers on drawing sheets only and use both the sides of the sheet.
 5. Use your own judgment for any unspecified dimension.
 6. Retain construction lines.
 7. All dimensions are in mm.

Q. 1 **(a)** Draw the curve traced by a point on the circumference of a disc of 50 mm   **06**
        diameter, which rolls along the ground for one complete revolution. Take
        initial position of generating point as a contact point of disc with ground.
        Also draw normal and tangent to the curve at any suitable point on the
        curve.

 (b) For the object shown in figure, draw the following views:

   (i)   Front view in direction of arrow.   **05**
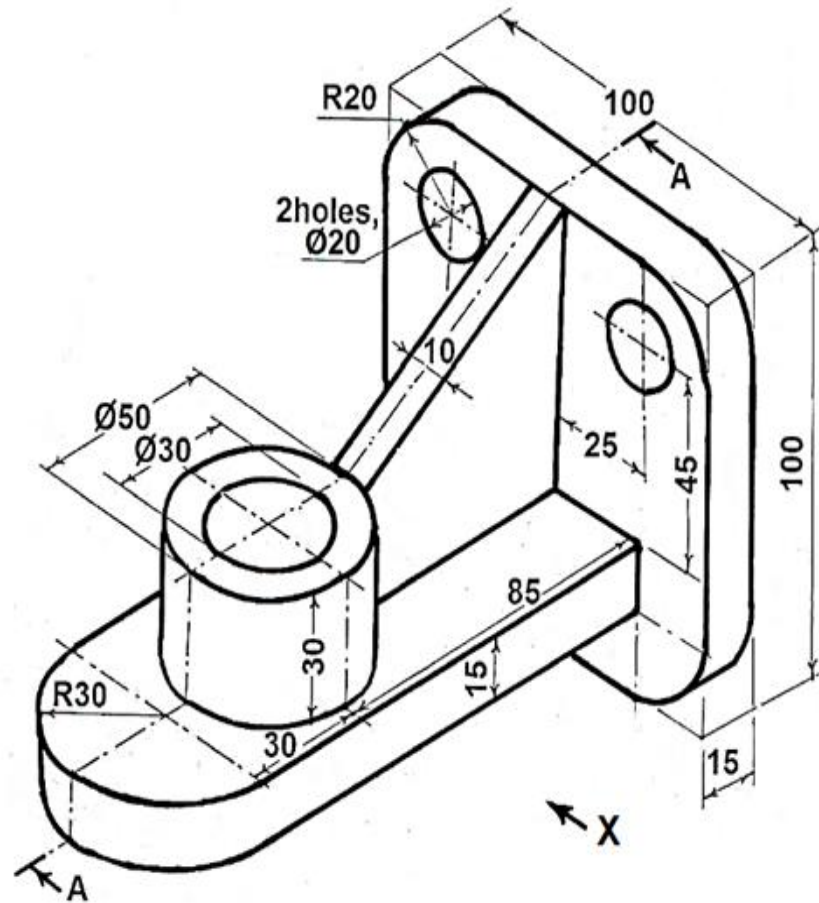   (ii) Top view   **04**
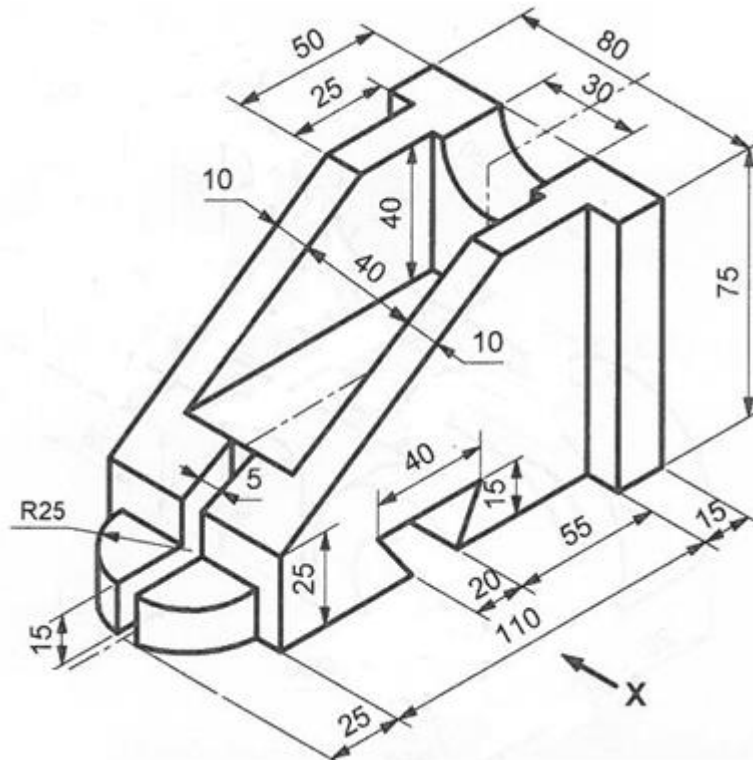
Q. 2   For the object shown in figure, draw the following views: **05**
(i) Sectional Front View along section plane A-A   **04**
(ii) Left Hand Side View
(iii) Top View   **04**
(iv) Show all dimensions   **02**

Q. 3   A pentagonal pyramid, base edges 25 mm and axis length 50 mm long has   **15**
one of its triangular faces in the V.P. and edge of the base contained by
that face makes an angle of 30° with H.P. Draw its projections.

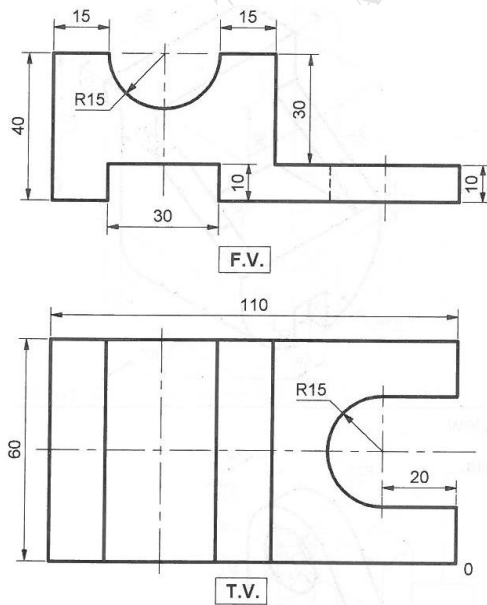**Q. 4   (a)**   A cylinder of diameter 45 and axis 60 mm long is resting on a point of its   **06**
base on H.P. with axis inclined at 35° to H.P. Draw the projections of
cylinder.

43510   **Page 2 of 3**

(b) Figure shows two views of an object. Draw isometric view of the object. **09**

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Q. 5 A regular pentagonal pyramid with the sides of its base 30 mm and height 80 mm rests on an edge of base. The base is tilted until its apex is 50 mm above the level of the edge of the base on which it rests. Draw the projection of the pyramid when the edge, on which it rests, is parallel to the V.P. and the apex of the pyramid points towards V.P. **15**

Q. 6 **(a)** A line AB 65 mm long, has its end A 20 mm above the H.P. and 25 mm in front of V.P. The end B is 40 mm above the H.P. and 65 mm in front of the V.P. Draw the projections of AB and show its inclinations with the H.P. and V.P. **07**

(b) Figure shows two views of an object. Draw isometric view of the object. **08**

FRONT VIEW

TOP VIEW

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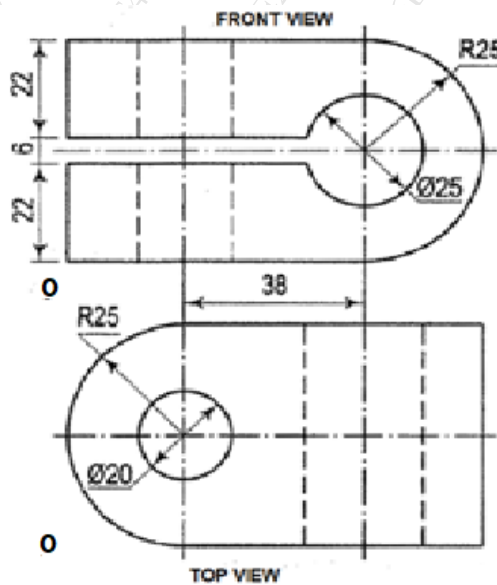
(Duration: 2 Hours)   **Total Marks: 40**

N.B: 1. Question No.1 is compulsory.
       2. Attempt Any three from the remaining five questions.
       3. Figures to the right indicate marks.
       4. Answer to all questions should be attempted and grouped together.

Q.1   A. While giving professional presentation, which types of verbal and non verbal
          communication will be applied? Explain.   (4)

       B. Identify the barriers from any two situations and briefly state how to overcome
          them.   (6)
          i) The well prepared and delivered speech was not understood by people in the
             village
          ii) An employee is not able to convince the boss to get pre-sanction the leave
          iii) Audience is unable to listen clearly the voice of an orator during the rally

Q. 2   A. Write a short note on objectives of communication.   (3)

       B. Classify the following instructions as Caution, Precaution, Warning & Note.   (2)
          1. Do not expose to the medicine to direct sunlight.
          2. Avoid smoking
          3. Wear Hand gloves
          4. Fill in the entries carefully

       C. Explain 'You Attitude' in business communication.   (3)

       D. Explain merits of oral communication.   (2)

Q.3   A. Write short note on Seven Cs in business letter.   (3)

       B. Any two types of barriers in communication.   (2)

       C. Explain 'The Importance of Body Language in Communication'.   (3)

       D. 'Silence speaks louder than words' Explain.   (2)

Q.4   A. Choose the useful app for an android mobile and give instructions to download and
          operate the same.   (5)

       B. You are the Branch Manager of "A1 Groups of Companies", Nagpur. You want to
          set up a new branch office in Kolkata. Place an order for office furniture to
          "Wooden Rock Planet Pvt Ltd", Mumbai.   (5)

Q.5   A. Write short note on SQ3R technique in reading   (2)

       B. Proteomics and its impact on communication at workplace   (3)

       C. Write short Notes on Complete Block Format with Layout   (2)

       D. Write short note on the importance of grammar and vocabulary in the language

         skills   (3)

Q.6   A. One word substitution   (2)

            1. One who loves mankind

            2. One who looks positive side of every problem

            3. One who eats human flesh

            4. One who speaks more languages

       B. Write a detailed note on the Communication Process with diagrammatic representation. Mention the details of the elements in communication process with a suitable example.   (3)

       C. Read the passage carefully and write the correct answer of the questions asked below the passage.

Many people believe that science and religion are contrary to each other. But his notation is wrong. As a matter of fact, both are correlated to each other. There is no doubt that the method of science and religion are different. The method of science is observation, experimentation and experience. Science takes it recourse to progressive march towards perfection. The rules of religion are faith, intuition and spoken word of the enlightened. In general, while science is inclined towards reason and rationality, spiritualism is the essence of religion.

In earlier times when man appeared on Earth, he was over-awed at the sight of violent and powerful aspects of nature. In certain cases, the usefulness of different natural objects of nature overwhelmed man. Thus began the worship of forces of nature — fire, the sun, the rivers, the rocks, the trees, the snakes etc. The holy scriptures were written by those who had developed harmony between external nature and their inner self. Their objective was to ennoble, elevate and liberate the human spirit and mind. But the priestly class took upon itself the monopoly of scriptural knowledge and interpretation to its own advantage.

Thus, the entire human race was in chains. Truth was flouted and progressive, liberal and truthful ideas or ideas expressing doubt and skepticism were suppressed and their holders punished. It was in these trying circumstances the science emerged as a savior of mankind. But its path was not smooth and safe. The scientists and free thinkers were tortured. This was the fate of Copernicus, Galileo, Bruno and others. But side by side science gained ground.

1. What is the reason for man worship the forces of nature?   (1)

2. According to the passage what is the difference between science and religion?   (1)

3. What was the objective of the authors of the holy scriptures?   (1)

4. According to the passage, at present juncture there is a need to: (1)

5. Why it is said in the passage that, "science emerged as a saviour of mankind"?   (1)

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N.B.:(1) **Question No 1 is Compulsory.**
  (2) **Attempt any three questions out of the remaining five.**
  (3) **All questions carry equal marks.**
  (4) **Assume suitable data, if required and state it clearly.**

Q.1	Attempt the following	**[20]**
a	Write a C program to convert binary number into decimal number.	**5**
b	What is the concept of Array in C?	**5**
c	Write a C program to reverse the digits of given number.(eg.If given number is 479 then its reverse is 974)	**5**
d	Differentiate between Structure and Union.	**5**
Q.2	Solve any Two	**[20]**
a	Write a program to find the second largest element of an array.	**10**
b	Explain any five string functions with example.	**10**
B	Write a C program to display following pattern using nested loops.	**10**

4444
333
22
1

Q.3	Solve any Two	**[20]**
a	What is recursion? Write a program using recursion to display Fibonacci series using recursion.	**10**
b	Explain Multidimensional array with example	**10**
c	Write an algorithm for solving quadratic equation.	**10**
Q.4	Solve any Two	**[20]**
a	Explain call by value and call by reference with example	**10**
b	What is Flowchart? Draw all basic symbols of flowchart and write its purpose.	**10**
c	Explain ant two types of operators in C	**10**
Q.5	Solve any Two	**[20]**
a	Write a C program to count Lower Case, Upper Case, Numbers and Spaces from a given statement.	**10**
b	Explain switch statement.	**10**
c	Explain of C program construct, Explain use of Header File. What if we do not use statement #include <stdio.h>.	**10**
Q.6	Write short note on	**[20]**
a	Control structures in C	**5**
b	Formatted i/o statement	**5**
c	Files in C	**5**
d	Applications of C programming.	**5**

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[Time: 2Hours]   [Marks:60]

Please check whether you have got the right question paper.

N.B: 1. Question No.1. is compulsory.
        2. Attempt any three questions from Q.2. to Q.6.
        3. Figure to the right indicates full marks.
        4. Atomic weights C=12,S=32,N=14,H=1,O=16,Cl=35.5.

1.   **Answer any FIVE from the following.**   **15**

a)   Define Corrosion with suitable example.

b)   What is Plain Carbon Steel? Give its classification.

c)   Define Net calorific value of a fuel.

d)   Write the function of Matrix phase of Composites.

e)   List the 12 principles of Green Chemistry.

f)   What is a Paint? List the various constituents of paint.

g)   Calculate the GCV of a coal sample having the following composition:

      $C = 83\%$; $H = 6\%$; $O = 3\%$; $S = 3.7\%$; $N = 2.5\%$; $Ash = 1.8\%$.

Q2.

a)   What is Chemical corrosion? Describe the mechanism of Oxidation corrosion with neat diagram.   **6 M**

b)   What is Cracking? Explain Fixed Bed catalytic cracking with a neat diagram.   **5 M**

c)   Calculate percent atom economy for the following reaction with respect to chlorobenzene   **4 M**
      $C_6H_6 + Cl_2 \rightarrow C_6H_5Cl + HCl$
      (Atomic weights: $C = 12$, $H = 1$, $Cl = 35.5$)

Q3.

a)   A gas has following composition by Volume: $H_2 = 20\%$, $CO = 22\%$, $CH_4 = 6\%$, $CO_2 = 4\%$, $O_2 = 8\%$, $N_2 = 40\%$.   **6 M**
      Calculate the volume of Air required for complete combustion of $1m^3$ of fuel.

b)   Highlight the Green Chemistry principle involved in the synthesis of Carbaryl. Also write the greener route of its synthesis.   **5 M**

c)   Differentiate between Galvanizing and Tinning.   **4 M**

Q4.

a) What is the purpose of making Alloys? Explain it with suitable examples. **6 M**

b) What is Differential Aeration corrosion? Explain it by giving an example and neat diagram. Write the Anodic and Cathodic reaction also. **5 M**

c) What are Composites? How are they classified? **4 M**

Q5.

a) Draw a neat labelled diagram of Hydrogen-Oxygen fuel cell and write the Anodic, Cathodic and overall cell reaction. **6 M**

b) Write the composition, properties & uses of
i) Gun Metal
ii) Duralumin **5 M**

c) What are Structural Composites? Explain Sandwich panel composites with a neat diagram. **4 M**

Q6.

a) How do the following factors influence the rate of corrosion:
i) Position of Metal in Galvanic series.
ii) Relative area of Anodic &Cathodic parts. **6 M**

b) 1.5 gram of air-dried coal sample was heated for 1 hour at 110^0 C, the dry coal sample weighed 0.985g. The crucible was covered with a vented lid and was heated strongly for 7 minutes at 975^0 C. The sample then weighed 0.813g. The crucible was then heated to a temperature of 750^0 C for half an hour. The weight of residue was found to be 0.13g. Calculate the % of Moisture, Volatile matter, Ash and Fixed carbon. **5 M**

c) What is powder metallurgy? Write the various steps involved in Powder Metallurgy. Mention the various applications of powder metallurgy. **4 M**

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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 $3x10^7$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