GN-9929

(3 hours)   [Total Marks: 75

N.B.

1. Question **No 1** is compulsory. Solve any **four** out of remaining **six** questions.
2. Use your own judgment for any unspecified dimension.
3. Solve by first angle method only.
4. Retain all construction lines.

Q1.Figure 1 shows pictorial view of an object .Draw
i) Front view   (5)
ii) Sectional right hand side view along section plane B-B.   (4)
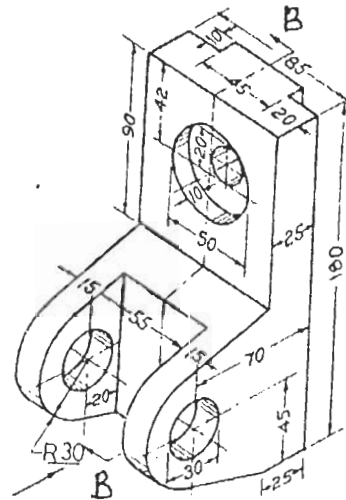iii) Top view   (4)
Dimension the views.   (2)

Figure 1

Q2) A square pyramid of 30 mm edge of base and 60 mm length of axis is having an edge of base inclined at 45° to the H.P. ... j in the V.P. Draw projections if the triangular face containing that edge is inclined at 30° to the V.P. **(15)**

Q3) A pentagonal pyramid, base 30 mm side and axis 60 mm long rests on one of its triangular faces in H.P. with an edge of base perpendicular to V.P. It is cut by a section plane which is perpendicular to H.P. and inclined at 30° to V.P. and bisecting the axis. Draw sectional front view, T.V. and true shape of section of pyramid. Also draw development of the lateral surface of uncut pyramid.   **(15)**

Q4 a) The projections of a line PQ measures 80 mm in the top view and 70 mm in the front view .The midpoint of the line is **45** mm in front of V.P. and 35 mm above H.P. End P is 10 mm in front of V.P. and nearer to it. The other end is nearer to **H.P.**   Draw   projections   of   the   line,   find   the   true   length   and   true   inclinations.
(12)   [Turn over

b) Draw free hand sketch showing three views of a hexagonal nut. (3)

Q5) Figure 2 shows front view and right hand side view of an object. Draw
  i) Sectional front view along section plane A-A (4)
  ii) Sectional side view along section plane B-B (4)
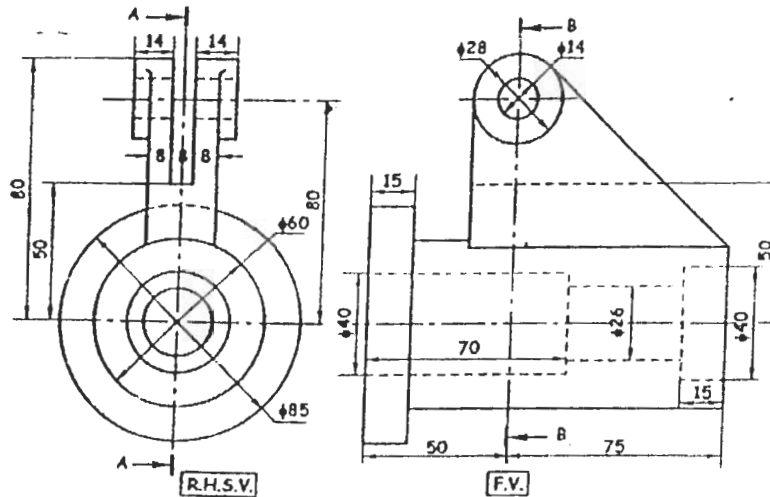 iii) Top view. (5)
  Dimension the views (2)

Figure 2

Q6 a) Two fixed points are 100 mm apart .A point P moves in such a way that the sum of its distances from the two fixed points is always a constant and equal to 150 mm. Trace the path of the point and name the curve. **(10)**

b) Draw free hand sketches of the following:-
  i) Conventional representation of internal and external threads when sectioned (2)
  ii) Acme thread profile (1)
  iii) Two views of head of any one set screw with its appropriate name. (2)

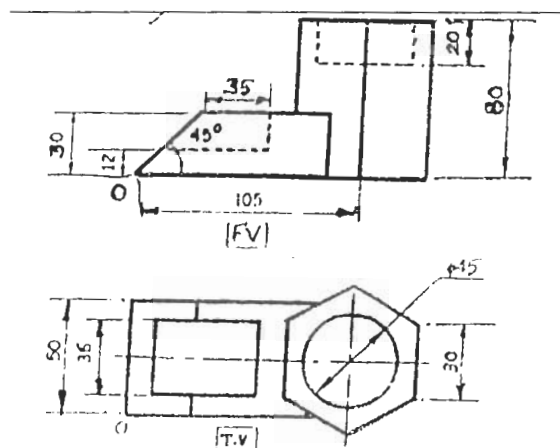**Q7)** Figure 3 shows two views of an object. Draw isometric view of the object. **(15)**

Figure 3

(2 Hours)   [Total marks: 75

NB:

1. Question 1 is compulsory. Answer any 4 of the remaining questions
2. Figures to the right indicate full marks.

Q1A). Answer any **six** of the following questions in one sentence: 6

i)   What is the first stage in the process of communication and who is responsible for it ?.
ii)   State two obstacles to faster reading.
iii) What are 'identification marks'?
iv)   Mention two types of listening.
v)   Mention two "Don'ts" of writing a business e-mail
vi)   What does 'jargon' mean?
vii) State two ways in which one can show leadership qualities during a Group Discussion.
viii) State two aspects of paralinguistic or non-verbal vocal cues.

B) Fill in the blanks: 5

i)   Halo and --------- effect is a kind of psychological barrier.
ii)   An enquiry letter written in reply to an advertisement is called a -----------enquiry letter.
iii) Tall, hierarchical structures in organizations give rise to -------- barriers.
iv)   The signature comes below the ---------   in a business letter.
v)   Concern for the reader's needs in business correspondence is called -----------------------.
vi)   ------------ listening involves putting yourself in the speaker's shoes.
vii) Failure of the sound system during a public speech is a ----------- barrier.
viii) The main parts of a definition are the term to be defined, the -----------to which the term belongs and
      the ------------.
ix)   Chronemics is an aspect of non-verbal communication related to -----------------.

C) State whether the following statements are **true** or **false**:   4

i)   There would be no semantic barriers if all people spoke the same language.
ii)   Letterheads used for official letters should be colourful and decorative in order to be attractive.
iii) The subject line in an e-mail is a crucial piece of your communication.
iv)   A technical description of an object   must always include precautions.
v)   The salutation in a business letter changes according to the inside address.
vi)   A summary is always written in the third person.
vii) LSWR refers to a new form of layout.
viii) "Assuring of our best services at all times" is a good closing sentence for a letter.

Q2-A) The *sender is largely responsible for the effective transmission of a message*. In the light of this statement explain what the sender of a message can do to minimize barriers in communication.

OR

What are the different types of Business Communication? Explain the significance of vertical communication in an organization. **10**

B) Identify the sender, receiver, channel, message and response in the following communication situations: **5**

1. A student sends an on-line application to ABC Company and receives a call for an interview.
2. An artist displays his paintings on *Unity in Diversity* at the K.G. Exhibition and earns critical acclaim for his work.

Q3.a) Gyanlal Textile Mills Ltd. Ahmedabad, have received an order for 1000mts of dark grey woolen suiting. They are out of stock for this particular shade but can offer suiting of a lighter shade and of a better quality at the same price. Write a persuasive letter on their behalf. (use semi-block format) **9**

b) Identify the communication barriers in the following situations: **6**

i) "It is quite tedious to manually work on students' records, but I'm afraid to use the computer because it might corrupt all our records."

ii) "This room is terrible to work in. I am able to hear everyone around and I can't concentrate."

iii) "I don't agree with you. I've specialized in this subject and have been frequently invited to deliver talks on this. I can't be wrong"

Q4.a) Write a **technical description of** a clinical thermometer OR a mini drafter. **9**

Or

Write a technical description of **the process of titration.**

b) State the differences between any **three** of the following: **6**

i) Formal and informal communication. ii) Sign and signal. iii) Semi-block and complete block layout.

iv) Connotation and denotation. v) Instructions and descriptions of a process. (State two differences each).

Q5a). As Sports Secretary of your college write a letter to a sports dealer making enquiries about prices of sports gear for cricket, badminton, tennis and chess. Give details of quality and quantity of goods required and set a deadline for the reply. (Use complete block form). **9**

B) Do as directed: **6**

i) We cannot ship the electric clocks ordered till you inform us what designs and colours you want. (Rewrite this sentence making it positive in approach.)

ii) We require more information to process your refund. (Use the You-attitude.)

iii) We would appreciate receiving the goods as early as possible since arrangements have to be made for export so that they will reach our foreign customer within the required time. (Convey the message concisely, precisely and clearly).

Q6   a). Write operating and maintenance instructions for use of -   7

a photocopier *OR* an overhead projector:

b) Write short notes on **two** of the following: 8

      i) The importance of a courteous, helpful attitude in writing business letters.

      ii)Netiquette

      iii) Grapevine communication.

Q7 Read the following passage and answer the questions given below:

After inventing dynamite, Swedish –born Alfred Nobel became a very rich man. By 1865 his factory in Krümmel near Hamburg, Germany, was exporting nitroglycerine explosives to other countries in Europe, America and Australia. Over the years he founded factories and laboratories in some 90 different places in more than 20 countries. Although he lived in Paris much of his life he was constantly traveling. Victor Hugo at one time described him as "Europe's richest vagabond". Intensive work and travel did not leave much time for a private life. At the age of 43 he was feeling like an old man. At this time he advertised in a newspaper "Wealthy, highly-educated elderly gentleman seeks lady of mature age, versed in languages, as secretary and supervisor of household." The most qualified applicant turned out to be an Austrian woman, Countess Bertha Kinsky. After working a very short time for Nobel she decided to return to Austria to marry Count Arthur von Suttner. In spite of this Alfred Nobel and Bertha von Suttner remained friends and kept writing letters to each other for decades. Over the years Bertha von Suttner became increasingly critical of the arms race. She wrote a famous book, *Lay Down Your Arms* ,and became a prominent figure in the peace movement. No doubt this influenced Alfred Nobel when he wrote his final will which was to include a Prize for persons or organizations who promoted peace.

 Nobel foresaw the universally destructive powers of dynamite and preferred not to be remembered as the inventor of this explosive; so, in 1895, he created a fund to be used for awarding prizes to people who had made worthwhile contributions to humanity. Originally, there were five awards: literature, physics, chemistry, medicine, and peace. Economics was added in 1968, 67 years after the first awards ceremony.

Nobel's original legacy of nine millions dollars was invested, and the interest on this sum is used for the awards, which varies from $30,000 to $ 125,000. The executors of his will were two young engineers, Ragnar Sohlman and Rudolf Lilljequist. They set about forming the Nobel Foundation as an organization to take care of the financial assets left by Nobel for this purpose and to coordinate the work of the Prize-Awarding Institutions. This was not without its difficulties since the will was contested by relatives and questioned by authorities in various countries.

Every year on December 10, the anniversary of Nobel's death, the awards (gold medal, illuminated diploma, and money) are presented to the winners. Several years after the death of Alfred Nobel, the Norwegian Storting (Parliament) decided to award the 1905 Nobel Peace Prize to Bertha von Suttner. Some people are of the opinion that politics plays an important role in the judges' decisions. Many of the awards have come as

surprises. Americans, who have won numerous science awards, have won relatively few literature prizes. Some people have won two prizes but this is rare; others have shared their prizes.

Q1. The word **foresaw** in line one of paragraph 2 is nearest in meaning to   1

   a) Prevailed.   b) Postponed.   C) Prevented.   D) Predicted.

Q2.The Nobel Prize was established in order to   1

   a) Recognize worthwhile contributions to humanity.
   b) Resolve political differences
   c) Honour the inventor of dynamite
   d) Spend money.

Q3. In which area have the Americans received the most awards?   1

   a) Literature. b) Peace. C) Economics. D) Science.

Q4. All of the following statements are true **except:**   1

   a) Awards vary in monetary value.
   b) Ceremonies are held on December 10 to commemorate Nobel's invention.
   c) Politics plays an important role in selecting the winners.
   d) A few individuals have won two awards.

Q5.In how many fields are prizes bestowed?   1

   a) 2   b) 5   c) 6   d)10

Q6. It is implied that Nobel's profession was in   1

   a) Economics   b) medicine   c) literature   d) science

Q7 How much money did Nobel leave for the prizes?   1

   a) $30,000   b) $ 155,000   c)$9,000,000   d) $125,000

Q8   What is the main idea of this passage?   1

   a) Alfred Nobel became very rich when he invented dynamite
   b) Alfred Nobel created awards in six categories for contributions to humanity
   c) Alfred Nobel left all of his money to science.
   d) Alfred Nobel made a lasting contribution to mankind.

Q9 The word 'legacy' in line one of the third paragraph is closest in meaning to   1

   a) Legend   b) bequest   c) prize   d) debt

Q10 Summarize the above passage in about 150 words and give a suitable title to it.   6

(3 Hours)   [Total Marks: 100]

N.B.: (1) Question No.1 is compulsory
      (2) Attempt any four questions from the remaining
      (3) Make suitable assumptions if required and state them clearly

Q 1. a Explain the significance of keywords 'public', 'static' and 'void', in main method of a java

        application program.   05

   b.   Explain the structure of Java Virtual Machine.   05

   c.   Write a program to evaluate sum of following series: 10

        $1 + 1 / x + 1/ x^2 + 1/x^3 + ...+ 1/ x^n$

        Take value of x and n as non zero- positive integers from user.

Q. 2. a Write a program to replace all the occurrences of a particular character in a line of   10

         text, with a new character. Take the input line and the two characters as a user input.

         For example if the text line is : keep our city clean

         The character ' e' to be replaced with '#' then the output is: k##p our city cl#an

   b.   Write an interactive program to create a Vector object and populate it with names of cities.

        Program should display and implement following menu choices: 10

             i)   Add city - if city name already exists in the Vector then program should display
                   appropriate message
             ii)   Remove city – if city does not exist in Vector then program should display
                   appropriate message
             iii) Display all- should display entire Vector content

Q. 3 . Assume a Bank maintains two kinds of accounts for its customers. One called savings account

        and the other current account. The savings account interest rate is 5% per year and for current

        account there is no interest. Saving account should hold a minimum balance but there is no
        -
        restriction on current account. Create an abstract class called Account that stores customer

        name, account number . Derive savings and current account classes from the Account class

        and add specific attributes to each of the derived classes. Write an interactive program to

create specific type of account and it should allow following functionality:

  i.   Accept deposits and update balance
  ii.   Compute and deposit interest
  iii.   Permit withdrawal and update balance

  Each of these functionality should be coded in appropriate classes   20

Q.4 a. What is Exception? Explain the exception handling in java with suitable examples   10

   b. Write a java applet to display a circle, a line and an arc inside the applet's visible area   10

Q.5. a. What are packages in java? With example show how to create a package in java and add

      classes to it.   10

   b. Each post-paid telephone connection object stores its telephone-number, customer-name and

      address. The telephone company wants to keeps a tab of how many post paid connections have

      been sold. Write a program to implement the above requirement and display total post-paid

      connections sold by the company.

      What additions will have to be made in post-paid telephone connection object to make the

      above possible?   10

Q.6 a. What is multithreading? Explain thread life cycle.   10

   b. The mains voltage supplied by a sub-station is measured at hourly interval for 72 hours.

      Write a program to display following: 10

         i.   The recorded voltage for 72 hours
         ii.   The hours (numbered 1 to 72) at which the recorded voltage varied from the
                mean by more than 10%.

 Q. 7 Write notes on (any two)   20

      a. Concept of streams in java and stream classes

      b. Difference between Abstract class and Interface

      c. Applet Life Cycle

Mk.H.1"HLF12.9

Con No. 3599-12.   GN-5150

(2 Hours)   [Total Marks : 75

N.B. (1) Question No. **1** is **compulsory**.

    (2) Attempt any **four** from remaining **six** questions.

    (3) Figures to the right indicate full marks.

    (4) Atomic weights: (C=12, H=1, O=16, N=14, S=32)

1.   Solve any Five from the following:-   15

   i   Give the anode and cathode reactions involved in the corrosion of steel pipe connected to copper plumbing.

   ii   Give the composition and uses of Duralumin.

   iii   1g of coal sample was used for determination of Nitrogen by Kjeldhal's method. The ammonia evolved was passed into 50ml of 0.1N sulphuric acid. The excess acid required 42ml of 0.1N NaOH for neutralization. Calculate the percentage of N_2.

   iv   What are green solvents? Give two industrial applications of green solvents.

   v   Explain the statement "A catalyst does not affect the position of equilibrium in a reversible reaction".

   vi   Give the classification of composite materials.

2.   (a)Discuss the effect of the following factors on the rate of corrosion: 6

     i.   Relative area of anode and cathode.

     ii.   pH

     iii.   Over voltage

   (b) An electric current is passed through two cells arranged in series containing $AgNO_3$ 5 and $ZnSO_4$ solutions with platinum electrons. If 216mg of silver is deposited in $AgNO_3$ / Pt cell, calculate the amount of Zinc deposited in $ZnSO_4$ /Pt cell. (At.wt of Ag=108 and Zn=65)

   (c) What is knocking? Define octane number. What is unleaded petrol?   4

3.   (a)Explain conventional and green route of manufacturing Adipic acid. Also justify why   6 the route is green.

   (b)What is cathodic protection? Discuss the sacrificial anode method of corrosion   5 control.

1   [TURN OVER

(c)A sample of coal has the following composition - C=90%, H=8%, N=2%, S=1.5%, O=5% and remaining ash. Calculate the GCV and LCV (Latent heat of condensation of steam=587cal/g). 4

4. (a) What is meant by activation energy? How does catalyst affect activation energy of 6 a reaction? Explain with at least one example the role of metal oxides as a catalyst.

(b)What are composite materials? Describe fiber reinforced composites. 5

(c)What is Powder metallurgy? Explain cold powder extrusion moulding. 4

5. (a)Explain concentration cell corrosion with the help of suitable examples. 6

(b)A gaseous fuel has the following composition by volume: H_2=35%, CH_4=45%, 5 C_2H_6=6%, CO=12% and remaining N_2. Calculate the minimum amount of air required at 27"C and 760mm Hg pressure for the complete combustion of 1 cu.m of the fuel.

(c)What are ceramic powders? Discuss the manufacture and uses of alumina. 4

6. (a)Discuss the refining of petroleum. Also give the different fractions with their boiling 6 ranges.

(b)Explain the absorption theory of catalysis. 5

(c)Calculate the percentage atom economy for the following reaction with respect to 4 acetanilide:

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

7. (a)What is cracking? Discuss the Fixed bed catalytic cracking method in detail. 6

(b)Discuss the electroplating method of applying metallic coating in detail. 5

(c)An air dried sample of coal weighing 2.9g was taken for volatile matter 4 determination. After losing volatile matter the coal sample weighed 1.96g. If it contains 4.5% moisture, Find the percentage volatile matter in it.

(2 hours) [Total marks : 75]

N.B. (i) Question no. 1 is compulsory.
    (ii) Attempt any four questions from Q.nos. 2 to 7.
    (iii) Figures to the right indicate full marks.
    (iv) Use suitable data wherever necessary.

1.   Attempt any five from the following: 15

(a)   Explain the effect on Newton's rings pattern when oil of refractive index (μ=1.65) is introduced between the lens (μ=1.5) and the glass plate (μ=1.75).

(b)   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?

(c)   Explain the terms: Stimulated emission and Population inversion.

(d)   Calculate the de Broglie wavelength of an electron whose kinetic energy is 120eV.   [$m_e = 9.1 \times 10^{-31}$ kg, h = 6.63×10^{-34} J-s].

(e)   Distinguish between paramagnetic and ferromagnetic materials.

(f)   Differentiate between step-index and graded-index fibre.

(g)   A magnetic material has magnetization of 2300A/m and produces a flux density of 0.00314 Wb/m^2. Calculate magnetizing force H and relative permeability of the material.

2. (a)   Derive the conditions for a constant thickness film to appear bright and dark when being viewed in reflected light.   8

  (b)   Describe the construction and working of He-Ne laser with schematic and energy-level diagrams.   7

3. (a)   What are anti-reflecting films? In costume jewelry, rhinestones (made of glass with μ =1.5) are often coated with silicon monoxide (μ = 2.0) to make them more reflective. How thick should the coating be to achieve strong reflections for 560nm light, incident normally?   8

  (b)   What is holography? Explain the construction and reconstruction of a hologram.   7

4. (a)   Develop one-dimensional time-dependent Schroedinger equation for matter waves.   8

  (b)   Discuss Weiss's theory of ferromagnetism and derive Curie-Weiss's law.   7

5. (a) What is an optical resonator cavity? What role does it play in producing laser beam? 5

(b) A mild steel ring having a cross-sectional area of $5cm^2$ and mean diameter 20cm has a coil of 200 turns wound on it. Calculate the reluctance R and the current required to produce flux of 1mWb (μ_r =380) neglecting air gap. 5

(c) An electron moves in the x-direction with a speed of 1.88×10^6 m/s. If this speed is measured to a precision of 1%, with what precision can you simultaneously measure its position? 5

6. (a) Explain the working principle of a pirani gauge. 5

(b) Describe the working of a scanning electron microscope (SEM) with diagram. 5

(c) What are hard and soft magnetic materials? Write their characteristic properties and applications. 5

7. (a) What is meant by numerical aperture of an optical fibre? An optical fibre has a numerical aperture of 0.20. Determine the acceptance angle for the fibre in water (μ =1.33). 5

(b) A monochromatic light from He-Ne laser λ = 6328Å is incident normally on a diffraction grating having 6000 lines/cm. Find angles at which first and second order maxima would be observed. 5

(c) Newton's rings are observed in reflected light of wavelength 5×10^{-5} cm. The diameter of 10th dark ring is 0.5cm. Calculate radius of curvature R and thickness of film t at the ring. 5

N.B. : 1. Q 1 is compulsory
2. Attempt any four questions from Q 2 to Q 7.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.

1. Attempt any five from the following: 15

   a) Differentiate between spontaneous emission and stimulated emission processes related to laser operation.
   b) Explain how the number of lines ruled per centimeter on plane transmission grating decides the maximum number of orders of diffraction?
   c) Why a ray of light takes a zigzag path in a step index fiber and sinusoidal path in a graded index fiber?
   d) A wedge shaped air film is illuminated by light of wavelength 4650 A˚ . The angle of wedge is 40". calculate fringe separation between two consecutive fringes.
   e) What do you mean by "phase velocity" and "group velocity" related to matter waves?
   f) Find relative permeability of a ferromagnetic material if the field strength of 220 amp/m produces a magnetization of 3300 amp/m.
   g) what is the role of resonant cavity in the operation of a LASER?

2. a) Describe in detail the concept of antireflection coating along with a proper ray diagram of thin film interference. Which conditions the material should satisfy to act as antireflection coating?   8
   b) A plain transmission grating has 15000 lines /inch. Find the angle of separation for 5048 A^0 and 5016 A^0 lines of Helium in second order spectrum?   7

3. a) Explain in detail the construction and working of ND-YAG laser with proper construction and energy level diagrams.   8
   b) Explain why Newton's rings are unequally spaced? If Newton's rings are formed using light of wavelength 5896 A^0 in reflected light with a liquid placed between plane and curved surfaces. The diameter of 7th bright fringe is 0.4 cm and radius of curvature is 1 meter. Find refractive index of liquid.   7

4. a) Discuss atomic origin of magnetization. What is Bhor magneton and it's significance?   8
   b) The position and momentum of 1 Kev electron are simultaneously measured. If the position is located within 1 A^0 what is the percentage of uncertainty in momentum? (M_a= 9.1x10^{-31}kg,e=1.6x 10^{-19}C)   7

5. a) What is Uncertainty Principle? Explain how the concept of wave particle duality and single slit diffraction of electron can be used to prove the Uncertainty Principle ?   8
   b) Write difference between LED and LASER diode. Discuss in short the application of laser in the field of communication.   7

6. a) Discuss the working of an Atomic Force Microscope with the help of a schematic diagram.   8
   b) Consider a multimode step index fiber with core index =1.53 and cladding index = 1.50. If core radius is 50 µm, calculate Numerical aperture, V number and number of modes transmitted through fiber using a wavelength of 1 µm.   7

7. a) What are three main ranges of vacuum on the basis of pressure. With the help of an appropriate diagram, explain the working of a thermocouple gauge.   8
   b) An iron ring of mean circumferential length 30 cm and cross sectional area 1cm^2 is wound uniformly with 300 turns. When current I = 0.032 amp flows through winding and flux in the ring is 2x10^{-6} wb. Find flux density, applied magnetic field strength and permeability of iron.   7

(3 Hours)   GN-1018

[Total Marks 100

N.B.: 1. Question **No. 1** is compulsory.

2. Attempt **any four** questions from remaining six questions.

3. Draw sketches wherever necessary.

Q.1.a . Evaluate : $\int_0^1 (x \log x)^4 dx$ (5)

b. Solve : $\frac{dr}{d\theta} = r \tan \quad -- \quad \frac{r^2}{\cos\theta}$ (5)

c. Evaluate: $\int_0^{a\sqrt{3}} \int_0^{\sqrt{x^2+a^2}} \frac{x\, dy\, dx}{y^2+x^2+a^2}$ (5)

d. Find by double integration the area enclosed by $y^2 = x^3$ and y = x   (5)

Q.2.a. Solve $(4xy + 3y^2 - x)\, dx + x(x + 2y)dy = 0$ (6)

b. Change the order of integration $\int_0^a \int_{\sqrt{a^2-y^2}}^{y+a} f(x,y)\, dx\, dy$ (6)

c. Prove that $\int_0^\infty \frac{dx}{(e^x+e^{-x})^n} = \frac{1}{4} \beta(\frac{n}{2},\frac{n}{2})$ and hence evaluate $\int_0^\infty sech^8 x\, dx$.   (8)

Q.3.a. Using Euler's method find approximate value of y at x=1 in five steps   (6)

taking h=0.2 given $\frac{dy}{dx} = x + y$ & $y(0) = 1$.

b. Evaluate $\int_0^2 \int_0^x \int_0^{x+y} e^{x+y+z}\ dz\, dy\, dx$ (6)

c. Evaluate by changing to polar coordinates $\int_0^1 \int_x^{\sqrt{2x-x^2}} (x^2 + y^2)\, dydx$ (8)

Q.4.a. Show that $\int_0^\infty \frac{\tan^{-1} ax}{x(1+x^2)}\ dx = \frac{\pi}{2} \log(1+a)$ (6)

b. Evaluate $\int_R \int \frac{y\, dx\, dy}{(a-x)\sqrt{ax-y^2}}$ where R is the region bounded by $y^2 = ax$ & y = x.   (6)

c. Solve by the method of variation of parameters $(D^2 - 2D + 2)y = e^x \tan x$ (8)

Q.5.a. Solve $(D^2 +2)y = e^x \cos x + x^2 e^{3x}$ (6)

b. Using Taylor's Method Solve $\frac{dy}{dx} = x^2 - y$ with y(0)=1. Also find y at x = 0.1   (6)

c. Find the Volume of the Tetrahedron bounded by the planes x = 0, y = 0, z = 0 & x+y+z = a   (8)

Q.6.a. In a single closed circuit, the current i at any time t, is given by $Ri + L\frac{di}{dt} = E$. (6)

Find the current i at a time t if at t = 0, i = 0 and L, R, E are constants.

b. Find the mass of the octant of the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$, the density at any point (6)

being kxyz.

c. Using Runge kutta's Fourth order method find y at x = 0.2 if $\frac{dy}{dx} = x + y^2$ given that y=1 (8)

when x = 0 in steps of h=0.1.

Q.7.a. State and prove Duplication formula for gamma functions. (6)

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

c. Solve: $(1 + 2x)^2\frac{d^2y}{dx^2} - 6(1+2x)\frac{dy}{dx} + 16y = 8(1 + 2x)^2$ (8)

(3 Hours) [Total Marks : 100]

N.B. : (1) Question No. 1 is **compulsory.**

(2) Attempt any **four** questions from the remaining **six** questions.

(3) Figures to the **right** indicate **full** marks.

Q1.a) Evaluate $\int_{0}^{\pi/2}\dfrac{d\theta}{\sqrt{\sin\theta}}\int_{0}^{\pi/2}\sqrt{\sin\theta}\,d\theta$ (20)

b) Solve $\left(1+e^{\frac{x}{y}}\right)dx + e^{\frac{x}{y}}\left(1-\dfrac{x}{y}\right)dy = 0$

c) Show that $\int_{0}^{\infty}\dfrac{\tan^{-1}ax}{x(1+x^2)}dx = \dfrac{\pi}{2}\log(1+a)$

d) Change the order of integration $\int_{0}^{1}\int_{2y}^{2\left(1+\sqrt{1-y}\right)}f(x,y)\,dxdy$

Q2a) Solve $(D-1)^2(D^2+1)y = e^x + \sin^2\left(\dfrac{x}{2}\right)$ (06)

b) Show that $\int_{0}^{\infty}xe^{-x^2}dx\int_{0}^{\infty}x^2 e^{-x^4}dx = \dfrac{\pi}{16\sqrt{2}}$ (06)

c) Using Runge-Kutta 4th order method find an approximate value of y given that (08)

$\dfrac{dy}{dx} = x + y^2$ with $x_0 = 0,\ y_0 = 1$ at $x = 0.1$ *and* $x = 0.2$

Q3 a] In a circuit containing inductance L, resistance R, voltage E, the current I is (06)

given by $L\dfrac{dI}{dt} + RI = E$ Find the current I at time t if at $t = 0$, $I = 0$ and L, R, E

are constant.

b) Find the area common of the circles $r = a$ and $r = 2a\cos\theta$ (06)

c] Solve $x^2\dfrac{d^2y}{dx^2} - x\dfrac{dy}{dx} + 4y = \cos\log x + x\sin\log x$ (08)

[TURN OVER

Q4 a) Find the volume bounded by $y^2 = x, x^2 = y$ and the plane $z = 0$ and $x + y + z = 2$　　(06)

b) Evaluate $\displaystyle\int_0^{\log 2}\int_0^x\int_0^{x+y}e^{x+y+z}dxdydz$　　(06)

c) Solve by method of variation of parameters $\left(D^2 - 3D + 2\right)y = \dfrac{e^x}{1+e^x}$　　(08)

Q5a) Using Euler's method find the approximate value of y where $\dfrac{dy}{dx} = x + y, y(0) = 1$　　(06)

taking h=0.2 at x=1.

b) A lamina is bounded by $y = x^2 - 3x, y = 2x$ .If the density at any point is given by $\dfrac{24}{25}xy$.　(06)

Find the mass of lamina.

c) Change the order of integration and evaluate $\displaystyle\int_0^a\int_{\frac{x^2}{a}}^{2a-x}xydydx$　　(08)

Q6 a) Change to polar coordinates and evaluate $\displaystyle\int_0^{\frac{a}{\sqrt 2}}\int_y^{\sqrt{a^2-y^2}}\log(x^2 + y^2)dxdy$　　(06)

b) Find the length of the cardiode $r = a(1 + \cos\theta)$ which lies out side the circle　　(06)

$r + a\cos\theta = 0$

c) State Duplication formula of Gamma Function and prove that

$\beta(n, n)\times\beta\left(n+\dfrac{1}{2}, n+\dfrac{1}{2}\right) = \dfrac{\pi}{n}\, 2^{1-4n}$　　(08)

Q7. a) Find the volume bounded by cylinder $y^2 + x^2 = 4$ and the plane $z = 0$　　(06)

　　and $y + z = 4$

b) Solve $y\left(xy + 2x^2y^2\right)dx + x\left(xy - x^2y^2\right)dy = 0$　　(06)

c) Solve $\left(D^4 + 2D^2 + 1\right)y = x^2\cos x$　　(08)