Duration – 3 Hours **Total Marks: 80**

(1) N.B.:- Question no 1 is compulsory.
(2) **Attempt any THREE questions out of remaining FIVE questions.**
(3) **Figures to the right indicate full marks.**

Q.1.a) Solve $\left[y\left(1+\frac{1}{x}\right)+\cos y\right]dx+(x+\log x-x\sin y)\,dy=0$ (3)

b) Find the particular integral of $(D^2-2D+1)y=xe^x\sin x$ (3)

c) Evaluate $I=\int_0^{\pi/4}(1+\cos 4\theta)^5\,d\theta$ (3)

d) Prove that $E\,\nabla=\nabla E$ (3)

e) Evaluate $\int_0^1\int_{y^2}^1\int_0^{1-x} x\,dx\,dy\,dz$ (4)

f) Using Euler's method, find the approximate value of y, where $\frac{dy}{dx}=\frac{y-x}{\sqrt{xy}}$ (4)
with y(1) = 2 when x = 1.5 in five steps taking h = 0.1

Q.2 a) Solve $dr+(2r\cot\theta+\sin 2\theta)d\theta=0$ (6)

b) Evaluate $\int_0^\infty \frac{e^{-x}}{x}\left(1-e^{-ax}\right)dx \quad (a>-1)$ (6)

c) Change to polar and evaluate $I=\int_0^a\int_{\sqrt{ax-x^2}}^{\sqrt{a^2-x^2}}\frac{dxdy}{\sqrt{(a^2-x^2-y^2)}}$ (8)

(6)

Q.3 a) Evaluate $I=\int_0^1 x^4\cos^{-1}x\,dx$

b) Evaluate $\iiint\frac{dxdydz}{x^2+y^2+z^2}$ throughout the volume of the sphere $x^2+y^2+z^2=a^2$ (6)

c) Apply method of variation of parameter to solve $\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=e^{-x}\log x$ (8)

Q. 4 a) Find the mass of a plate in the form of a cardioid $r = a(1-\cos\theta)$, if the density at any point of the plate varies as its distance from the pole. (6)

b) Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = 2xe^{3x} + 3e^x \cos 2x$ (6)

c) Using fourth order Runge-Kutta method, solve numerically, the differential equation $\frac{dy}{dx} = xy$ with the given condition y(1) =2, find y at x=1.2,1.4 (8)

Q. 5 a) Evaluate $\iint xy\, dxdy$ over the region bounded by $x^2 + y^2 - 2x = 0,\ y^2 = 2x$ *and* $y = x$ (6)

b) A resistance of $100\ \Omega$ and inductance of 0.5 H are connected in series with a battery of 20 V. Find the current at any instant if the relation between L, R, E is $L\frac{di}{dt} + Ri = E$ (6)

c) Evaluate $\int_0^1 \frac{dx}{1+x}$ by using (i) Trapezoidal Rule, (ii) Simpson's $(1/3)^{rd}$ Rule and (iii) Simpson's $(3/8)^{th}$ Rule. Compare the result with exact solution. (8)

Q. 6 a) Solve $(3x+2)^2\frac{d^2y}{dx^2} + 3(3x+2)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1$ (6)

b) Show that the length of the parabola $y^2 = 4ax$ from the vertex to the end of the latus rectum is $a\left[\sqrt{2} + \log\left(1+\sqrt{2}\right)\right]$ (6)

c) Find the volume bounded by the paraboloid $x^2 + y^2 = a\,z$ and the cylinder $x^2 + y^2 = a^2$ (8)

_____

Time: 2 Hours **Total Marks: 40**

1) **Question 1 is compulsory**
2) **Attempt any (3) out of remaining (5)**

Q1. a) Choose the correct option: **(4)**

i] Which of these must be avoided for effective communication?
A) Sharing of activity B) Listening C) Ambiguity D) Politeness

ii] Reading a book to get a deep idea of the content is called as_____.
A) Scanning B) Skimming C) Intensive reading D) Extensive reading

iii] I can't believe that was our test. I think it was easier than some of our homework! It was a _____
A) a leap in the dark B) a lick and a promise C) a bridge too far D) a piece of cake.

iv] Find a word for: "happening again and again"
A) Condemning B) Calculating C) Chronic D) Creating

v] The Salutation should be written _____
A. Below the Inside address. B. Above the Inside Address. C. Above the date D. None of these.

vi] When is the communication process complete?
A) When the sender transmits the message B) When the message enters the channel
C) When the message leaves the channel D) When the receiver understands the message.

vii] In the Complete Block format of letters paragraphs are_____
A) Aligned B) Not aligned C) Indented D) Not indented

viii] 'Wear helmet while driving a two-wheeler' is an example of
A) Danger B) Warning C) Caution D) Note

b) Differentiate between the Semi Block format and Modified Block format of letters. (2)
c) Define chronemics. (2)
d) Why is technical writing? How is it different from other forms of writing? (2)

Q2 a) With the help of examples, explain what are gestures and their role in effective communication. (4)
b) What is horizontal communication? State any (2) advantages of this type of communication. (4)
c) 'We have looked into the matter and realized that your claim is false.' Which principle of letter writing is missing in this reply to complaint letter? Rewrite the statement in accordance to the principle named by you. (2)

Q3 a) Justify the statement that non-verbal communication plays a significant role in the communication process. Give appropriate examples. (4)
b) You purchased a branded blazer for an important college event. You gave it for fitting but the evening before your event when you went to collect the altered blazer, it was not ready. Write a letter to the owner asking for appropriate compensation. Use the complete block format. (6)

Q4. a) Give a diagrammatic representation of a letter with all the optional parts. Write a short note on any one of the optional parts. (4)

b) As the member of the Students' Council, you have been given the task of organizing a "Campus to Corporate" training for the third-year engineering students. Write a letter of enquiry to a training company for the details. Give necessary details. Use the Modified block format. (6)

Q5. a) Write a short note on the different features of email. (4)

b) Give the difference in meaning for each of the following pair of words: (2)

i) complement compliment

ii) foreword forward

c). With the help of a diagram describe **any one** of the following: (4)

i) Electric kettle

ii) Process of making a key rack in workshop

Q6. a) Read the following passage and answer the question given below: (6)

During the Gulf War, a few years back, tens of thousands of seabirds were killed due to oil spills. Do you know what makes crude oil on ocean water so deadly?

Crude oil is not used in the same state it is produced at the off-shore wells. it is converted in refineries into a wide range of products such as gasoline, kerosene, diesel, fuel oils, and petrochemical feed-stocks. Before it is refined, the oil also contains potentially fatal components.

Crude oil is made up of compounds of carbon and hydrogen called hydrocarbons. These hydrocarbons may be paraffin, the oil that is used as fuel in heaters and lamps or cycloparaffins (naphthenes) or aromatic compounds in varying proportions. While crude oil found in the US is mostly paraffinic, that found along the Gulf Coast are naphthenic which contain sulphur compounds in varying amounts, a small amount of nitrogen and very little oxygen. Every variety of crude oil has nickel and vanadium in high concentration. Iron may be found in organic form due to the corrosion of pipes. Paraffin like methane and ethane are asphyxiants, substances that cause suffocation. The effects of cycloparaffins are more or Less similar to those of the paraffin but unsaturated paraffin are more noxious than the saturated ones. The sulphur present in crude oil may be toxic. The mechanism of toxic action seems to involve its breakdown to hydrogen sulphide. They will act principally on the nervous system with death resulting mainly from respiratory paralysis. Sulphur in the form of aromatic thiophenes, benzothiophenes can damage the livers and kidneys of sea animals. Sulphur compounds Like mercaptans can be very dangerous too.

On the basis of your reading of the above passage, choose the correct options from the ones given:

(a) Thousands of sea birds were killed due to oil spills because _____

(1) it suffocated them (ii) it was poisonous

(iii) birds couldn't enter the sea (iv) there was no fish to feed on

(b) The primary components of crude oil are _____

(i) methane and ethane (ii) carbon and hydrogen

(iii) sulphur compounds (iv) naphthenes

(c) Sulphur in crude oil _____

(i) damages nervous system (ii) damages the livers and kidneys

(iii) causes suffocation (iv) causes respiratory problems

(d) Every variety of crude oil contains _____ in excess.
(i) sulphur (ii) oxygen (iii) nitrogen (iv) nickel

(e) Asphyxiants cause death by
(i) drowning (ii) suffocation (iii) wounds (iv) cancer

(f) The word 'refined' means _____
(i) pure (ii) impure (iii) fine (iv) nice

(b). Prepare a set of instructions to follow while using a selfie-stick to click a photograph with a mobile phone. (04)

Time: 3 Hours **Marks: 80**

N.B

(1) Question no. 1 is compulsory.
(2) Attempt any 3 from the remaining questions.
(3) Assume suitable data if necessary.
(4) Figures to right indicate full marks.

Q.1 a. Attempt multiple choice questions. **10**

i. Which of the following is valid variable name?
(a) case (b) int_rate2 (c) 2sum (d) for

ii. The operator -- is a
(a)Unary operator (b) Binary operator (c) Ternary operator (d)Conditional operator

iii. Control automatically passes to the beginning of loop by using
(a) break statement (b) goto statement (c) continue statement (d) none of these

iv. '&' is a ---------- operator.
(a) Unary operator (b) Value operator (c) Address operator (d) none of these

v. do.....while is _____ control loop.
(a) exit (b)entry (c) count (d)all of these

vi. Which is the correct way to declare a pointer?
(a) int *ptr (b) int ptr* (c) * int ptr (d) none of these

vii. Which of the following belongs to derived data type.
(a) structures (b)union (c)pointers (d) all of the above

viii. Which function used to write a character to a file
(a)fputc() (b)fgetc() (c) fputs() (d)fwrite()

ix. Each case statement in switch () is separated by
(a) break (b) continue (c) goto (d) none of these

x. Which of the following #define statement is valid?
(a) #define x=10 (b) #define x 10; (c) #define x 10 (d) # Define x 10

b. a. Convert the mathematical expression into equivalent C expression **03**

i. $$a = \frac{xy + z\left(\frac{x}{y}\right) + zy}{x + y + z}$$

ii. $$r = \frac{2v + 6.22(c + d)}{g + v} + \frac{3}{c/d}$$

iii. $a = x^{y^z}$ [hint: use function from math library]

c. If x ,y and z are int variable then evaluate the following expression and give final value of x,y ,z and p. **02**

x =10, y =6, z=8

i. p = x-- +y--+--z/(x*x)

ii. p = --x + ++y *z--;

d. Compare structure and union with proper example. **02**

e. Explain pointers with example. How array is related with pointers? **03**

Q.2 a. What is function? What do mean by calling function and called function? What are function parameters? Using return statement can we return multiple values to calling function? If no then what solution is available? Explain with example. **12**

b. Explain break and continue statements with suitable example. **08**

Q.3 a. WAP to sort the array in ascending order. **10**

b. WAP to accept a string and count no. of vowels and consonants, spaces, digits and special characters in it. **06**

c. WAP to find maximum of three numbers using conditional operator. **04**

Q.4 a. Create a structure Patient having ID, patient_name and disease_name as data members. WAP to read details of 10 patients and print details of those patients having 'diabetes'. **12**

b. What is a file? What are different types of files? Explain the following file handling functions in c. **08**
i) fopen () ii) fprintf () iii) fscanf () iv) fgets() v)fputs() vi) fclose()

Q.5 a. WAP to check whether entered matrix is symmetric or not. **10**

b. Explain difference between auto and static storage class with suitable example. **05**

c. WAP to print a pattern **05**

```
    *
  *   *
*   *   *
  *   *
    *
```

Q.6 a. What is recursion? How it is different from iteration? WAP to compute factorial of a number using recursion. **12**

b. WAP to print Fibonacci series upto n. [Note: n entered by user, use iterative stmt] **08**

Time: 2 Hrs **Marks : 60**

N.B. 1) Question **No 1** is compulsory.
2) Attempt any three questions from the remaining questions.
3) Assume suitable data and symbols if required.
4) Figures on the right indicate full marks.

Q.1 Attempt any **FIVE.** (15)

a) What is Rayleigh's criterion of resolution? Define resolving power of grating.
b) A superconductor has a critical temperature 3.7^0 K. At 0^0K the critical magnetic field is 0.0306 Tesla. What is the critical magnetic field at temperature 2.0^0K?
c) An electron is bound in a one dimensional potential well of width 2 A^0 but of infinite height. Find its energy values in the ground state and first excited state?
d) What are the advantages of use of optical fibre in communication system?
e) Explain measurement of frequency of AC signal using CRO.
f) What is acronym of 'LASER'? How are they different than ordinary rays?
g) What do you understand by a thin film? Comment on the colours in thin film in sunlight.

Q.2 a) Prove that the diameter of n^{th} dark ring is proportional to square root of natural number in case of reflected system. What will be the order of the dark ring which will have double the diameter of the 40^{th} dark ring? (8)
b) A multimode step index optical fibre has core radius of 3 μm and its core refractive index is 1.45. Calculate i) refractive index of cladding ii) acceptanceangle iii) the number of modes propagating through fibre when wavelength of light is 1μm. (7)

Q.3 a) With neat energy level diagram explain principle, construction & working of He-Ne laser? (8)
b) Derive the condition for a thin transparent film of constant thickness to appear bright and dark when viewed in reflected light. (7)

Q.4 a) What is the highest order spectrum which can be seen with monochromatic light of wavelength 6000 A^0 by means of diffraction grating with 5000 lines/cm. (5)
b) Derive Schrodinger's time dependent wave equation for matter waves. (5)
c) Distinguish between Type I and Type II superconductors? (5)

Q.5 a) Show that electron cannot exist inside the nucleus using Heisenberg's uncertainty principle. (5)
b) A plane transmission grating having 6000 lines/cm is used to obtain a spectrum of light from a sodium lamp in the second order. Calculate the angular separation between the two sodium lines whose wavelengths are 5890 A^0& 5896 A^0? (5)
c) With neat diagram explain construction & working of Scanning Electron Microscope. (5)

Q.6 a) What are carbon nano tubes & what are their properties? (5)
b) Derive Bethe's law for electron refraction? (5)
c) The electron which is at rest is accelerated through a potential difference of 200V. Calculate i) the velocity of electron ii) De-Broglie wavelength (5)

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[Time: 2 Hours] **[Marks:60]**

Please check whether you have got the right question paper.

N.B:
1. Question No.1 is compulsory.
2. All questions carry equal marks.
3. Answer any three questions from remaining five questions.
4. Atomicweights:(Ca=40,Mg=24,Cl=35.5,S=32,H=1,C=12,O=16,Na=23,N=14,Al =27,Fe=56, Ba =137.3)

Q.1) Answer any **five** from the following: - **[15 M]**

a) Differentiate between anodic and cathodic coatings.

b) What is the significance of proximate analysis of coal?

c) Give Composition, Properties and Uses of **Duralumin.**

d) Mention any four properties of composite materials.

e) State any six principles in green chemistry.

f) What are the main constituents of paints?

g) 2.5 g of the coal sample in a Bomb-calorimeter experiment gave 0.82g $BaSO_4$. Calculate percentage of S in the coal sample**.**

Q.2] a) Explain the mechanism of following types of corrosion:- **[06M]**
i) Pitting corrosion ii) Galvanic cell corrosion

b) Write informative note on Fixed bed catalytic cracking. **[05M]**

c) Calculate % Atom Economy for the following reaction **[04M]**

$$C_6H_5CHO + CH_3CHO \xrightarrow{NaoH} C_6H_5CH{=}CHCHO + H_2O$$

Q.3] a)) A fuel sample has the following composition: H_2=15%, CH_4 =25%, C_2H_4 = 30%, CO = 15%, CO_2 = 3%, and remaining nitrogen. Calculate the volume of oxygen and air required for complete combustion of 5 m^3 of fuel. **[06M]**

b) Explain Conventional and Greener route for synthesis of Indigo dye. Mention the green Chemistry principle involved**.** **[05M]**

c) Discuss the following factors influencing the rate of corrosion:

i) Nature of oxide film ii) Moisture **[04M]**

Q.4] a) What are alloys? Explain the purpose of making alloys. **[06M]**

b) What is the principle of cathodic protection? Explain any one protection method. **[05M]**

c) Write note on 'Particle reinforced composites' **[04M]**

Q.5] Write informative note on Biodiesel. **[06M]**

b) What is powder metallurgy? Explain hot compaction method. **[05M]**

c) Write a note on dispersed phase of composite materials. **[04M]**

Q.6] a) Define corrosion. Explain the mechanism of electrochemical corrosion in acids. **[05M]**

b) A coal sample contains, C=70%, O=23%, H= 5%,N=0.4 and remaining Ash. Calculate the GCV and NCV of given coal sample. **[05M]**

c) Write a note on:- **[05M]**

i) powder injection moulding ii) Sintering

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(3 Hours) **Marks : 60**

Instructions:

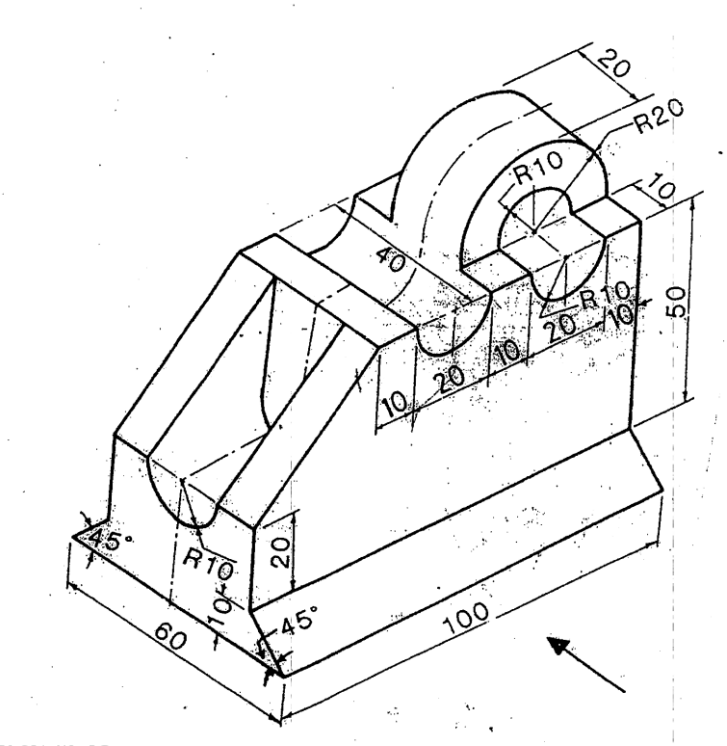
1. Question no 1 is compulsory.
2. Answer any three questions from the remaining five.
3. All dimensions are in millimeters.
4. Retain all construction lines.
5. Use scale 1:1 only.
6. Figures to the right indicate full marks.
7. Use first angle method of projection only.
8. Assume suitable additional data, if necessary and mention it clearly.

Q1 a) A circle of diameter 60 mm rolls without slipping on a vertical surface for half revolution and then on a horizontal surface for remaining half revolution. Draw the locus of a point "P" which is initially in contact with wall. Name the curve. **6**

b) Figure given below shows pictorial view of an object. Draw the following views-

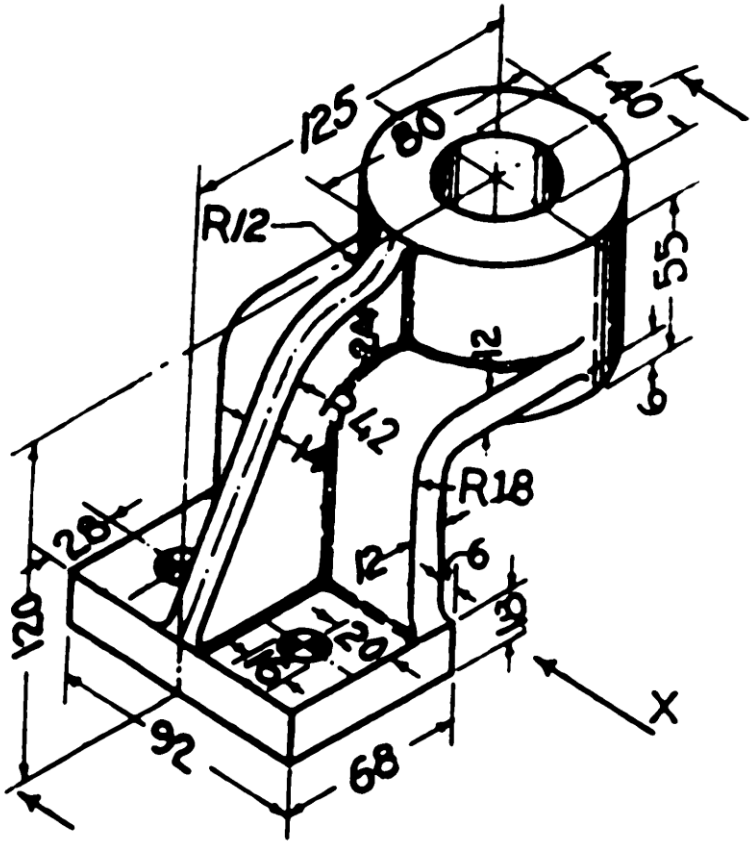
Front view **5**

Top view **4**



Q2 Figure below shows pictorial view of an object. Draw the following views-

Sectional Front view	**5**
Top view	**4**
Side view from left	**4**
Give 10 major dimensions	**2**



Q3 A hexagonal pyramid, base 25 mm side and axis 55mm long, has one of its slant edges on the H P. A vertical plane containing that edge and axis is inclined at 45^0 to VP. Draw its projections when the apex is nearer the VP.
(Stage 1: 3 marks, stage 2: 5 marks, stage 3: 7 marks)

Q4 A pentagonal pyramid side of base 30 mm, axis 60mm is resting on its base on HP with one edge of base parallel to VP and nearer to VP. A vertical section plane inclined at 45^0 to VP cuts the pyramid at a distance of 9 mm from the axis. Draw

Sectional front view **3**

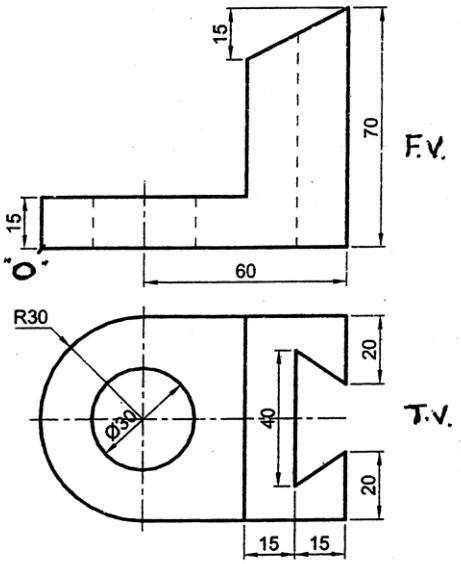
Top view **3**

True shape of section **3**

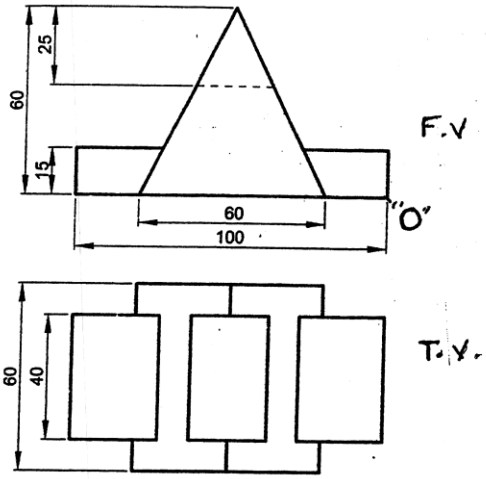
and development of lateral surface of retained part of the pyramid. **6**

Q5 a) draw the projections of a cylinder 60 mm diameter and 70 mm long, lying on HP on its curved surface with its axis inclined at 30^0 to VP. (and parallel to HP) (Stage 1: 2 marks, Stage 2: 4 marks)

b) The front view and top view of an object are shown in figure below. Draw its isometric view.



Q.5 (b)



Q.6 (b)

Q6 a) The top view of a 75 m long line AB measures 65 mm, while the length of its front view is 50 mm. It's one end A is in the HP and 12 mm in front of VP. Draw its projections and determine its inclinations with HP and VP. **8**

b) The front view and top view of an object are shown in figure above. Draw its isometric view. **7**
