Total No. of printed pages = 4

PH 181101

Roll No. of candidate

2019

B.Tech. 1st Semester End-Term Examination

PHYSICS–101

(New Regulation) (w.e.f. 2017–18) &

(New Syllabus – Group-B) (w.e.f. 2018–19)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer Question No. 1 and any *four* from the rest.

1. Fill in the gaps of the following: (10 × 1 = 10)

    (i)   The differential form of Mannull's equation
          ——————— signifies Gauss's laws for
          magnetism

    (ii) The area of the B–H loop for soft iron
          compared to that of steel is ———————.

    (iii) Chromatic aberration in a lens occurs due to
          the phenomenon of ——————— of light.

    (iv) The central fringe of the Newton's Rings formed
          by reflected light is ———————

(v) The topmost filled energy level at 0°K is called _____

(vi) The potential energy of a freely moving particle in 1–D potential well is _____

(vii) Heisenberg's uncertainty principle concerning the uncertainties in the momentum and position of microscopic particle given by the equation _____

(viii) In an optical fibre the refractive index of the core is _____ than that of the cladding.

(ix) The ratio of Einstein's coefficients of spontaneous emission of stimulated emission varies with the frequency of the incident radiation as _____

(x) The Poisson's equation is reduced to the Laplace's equation in _____

2. (a) A body is moving with velocity $v = \left(2x\hat{i} + 2y\hat{j}\right)$ m/s, show that the motion of the body is irrotational.

(b) Discuss various properties of Diamagnetic, paramagnetic and Ferro magnetic substances citing examples.

(c) Show that the Ampere's law inconsistent in time varying field. In view of this establish the modified Ampere's law.   (4+5+6 = 15)

3. (a) What is spherical aberration and chromatic abbreviation?

   (b) Find the actual path difference between the interfering reflected rays incase of a thin film. Hence find the conditions for constructive and destructive interference.

   (c) The objective of a telescope of focal length 90 cm is an achromatic combination of two lenses in contact. If the depressive powers of the lenses are 0.024 and 0.036 respectively, find the focal lengths of the two lenses. (4+7+4 = 15)

4. (a) What do you mean by population inversion in LASER? Explain briefly how it is achieved He-Ne laser.

   (b) What is holography? Explain briefly about its principle.

   (c) The refractive indius of the can and the cladding of an apical fibre are 1.50 and 1.47 respectively. Calculate the numerical aperture and acceptance angle. (6+4+5=15)

5. (a) Discuss the properties of a wave packet representing a quantum particle.

   (b) For a 1–D potential well, solve the Schrodirger's equation to show the discrete nature of energy.

   (c) The de Broglie wavelength of electron is 73 A°, find the velocity of the electron. (5+6+4 = 15)

6. (a) Explain the band theory of solids.

   (b) Define Fermi level and density of status

   (c) Write few merits and demerits of free electron theory. (7+4+4 = 15)

7. (a) Explain the working of light emitting Diode (LED).

(b) What is Meissner effect? Differentiate between type–I and type –II super conductors.

(c) The critical temperature of a metal with isotopic mass 1995 amu is 4.185k. Calculate the isotopic mass of the metal if the critical temperature falls to 4.133 k.   (5+5+5 = 15)

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16 (HU 105) TRW

2019 C

TECHNICAL REPORT WRITING

(New Syllabus)

Full Marks : 50

Time : 1½ hours

The figures in the margin indicate full marks for the questions.

Answer Q. No. **7** and **any five** from the rest.

1. Describe in detail, the different categories of Technical Reports.   8

2. What are the structural features of a Technical Report ?   8

3. Define a Memo. What are the different types of memos ? Describe in detail.   8

4. Define an analytical report.   8

5. Write in your own words the feature of an informative report.   8

6. How can clarity be achieved in a technical report ?   8

7. Write in your words **any one** of the following :   10

    (a) The present day Media : Its perspectives, good or bad

    (b) The Devastating Floods in Assam.

Total No. of printed pages = 3

HS 181108

Roll No. of candidate

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2019

B.Tech. 1st Semester End-Term Examination

COMMUNICATION AND PROFESSIONAL SKILLS

(New Regulation) (w.e.f. 2017-2018) and
(New Syllabus) – Group A (w.e.f. 2018-2019)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest.

1. Rewrite as directed :   (10 × 1 = 10)

   (i)   The ordered ——————— my dismissal.
        (use correct preposition in the blank).

   (ii) The will not come if it ——————— (rain)
        today (use the correct form of the verb)

   (iii) One who knows everything: ———————
        (Express in one word)

   (iv) Where you are coming from (write the correct
        interrogative form of the sentence)

[Turn over

(v) As I awoke the thief ran ————————
(use appropriate adverb)

(vi) When you are guilty you must suffer
(use appropriate conjunction)

(vii) You said to John, "Will you help me?"
(Rewrite in indirect speech)

(viii) Have you done the work?
(Rewrite in passive construction)

(ix) The infused a new spirit at us
(correct the mistake in the sentence)

(x) Write synonym of the word "communication".

2. (a) Explain the behavioral aspects of soft kills. (5)

(b) List four elements of effective presentation. (4)

(c) What do you understand by Group Discussion? Briefly mention the components of a Group Discussion. (2+4)

3. (a) Discuss the importance of Communication in professional carrier. (5)

(b) Write the characteristic of communication. (4)

(c) What is communication breakdown? Mention some aspects of communication breakdown. (2+4=6)

HS 181108

2

4. (a) What is audience analysis? Write the role of audience analysis in effective presentation.
   (3+4=7)

   (b) What is audience profile? How does it help to analyze audience? (4)

   (c) What is rapport? How does rapport help to make communication successful? (1+3=4)

5. (a) List the characteristics of a good technical report. (7)

   (b) Explain the role of methodology in report writing. (4)

   (c) Write the key features of an abstract of a report. (4)

6. (a) Prepare a Curriculum vitae for a fresh engineering graduate. (7)

   (b) Explain the characteristic of a good cover letter. (4)

   (c) What is memo? Write the importance of memo in professional writing. (1+3=4)

7. (a) List the structure of a research paper. (7)

   (b) Write a note on secondary sources of data. (4)

   (c) Discuss bibliography as a source of information. (4)

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———

16 (HU 105) TRW

2019 C

TECHNICAL REPORT WRITING

(New Syllabus)

Full Marks : 50

Time : 1½ hours

The figures in the margin indicate
full marks for the questions.

Answer Q. No. **7** and **any five** from the rest.

1. Describe in detail, the different categories of Technical Reports.   8

2. What are the structural features of a Technical Report ?   8

3. Define a Memo. What are the different types of memos ? Describe in detail.   8

4. Define an analytical report.   8

5. Write in your own words the feature of an informative report. 8

6. How can clarity be achieved in a technical report ? 8

7. Write in your words *any one* of the following : 10

   (a) The present day Media : Its perspectives, good or bad

   (b) The Devastating Floods in Assam.

Total No. of printed pages = 4

CS 181106

Roll No. of candidate

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest :

1.   Answer the following (MCQ/Fill in the blanks)
                                           (10 × 1 = 10)

   (i)   Ternary operator operates on how many
         operands?

         (a) 1   (b) 2

         (c) 3   (d) 4

(ii) Which among the following is a multi-way decision statement?

(a) if-else   (b) if-else-if

(c) switch   (d) do-while loop

(iii) The —————— statement is used to terminate the execution of the nearest enclosing loop in which it appears

(iv) Variable declared inside a function is known as ——————

(v) When a function is recursively called all the automatic variables an stored in a

(a) Stack   (b) Queue

(c) Array   (d) Register

(vi) Which keyword allows a variable to have file scope?

(a) Auto   (b) Static

(c) Register   (d) Extern

(vii) —————— searching method in which an array is searched by checking elements one at a time

(viii) Strlen ("oxford university press") is?

(a) 22   (b) 23

(c) 24   (d) 25

(ix) Every string is terminated with a ——————

(x) Typedef can be used with which of these data types?

(a) Struct   (b) Union

(c) Enum   (d) All of these

2. (a) Differentiate between type casting and type conversion write short note on operators variable in C language. (3+5=8)

   (b) Write a program to find whether the given number is an arunstrong number or not. (7)

3. (a) Write a short note on iterative statements that C language supports. Explain usefulness of default statement in switch case statement. (4+3=7)

   (b) Write a program to enter a decimal number calculate and display binary equivalent of this number. (8)

4. (a) Differentiate between function declaration and function definition. Differentiate between formal parameters and actual parameters. (3+4=7)

   (b) Write a program to print the fibonacci series using recursion. (8)

5. (a) What is the advantages of using structures? Differentiate between structure and an array. (3+4=7)

   (b) Write a program to read and display the information of all the students in a class using array of structure. (8)

6. (a) What do you understand by preprocessor directive? Explain all the types of preprocessor directives. (2+8=10)

   (b) Write a program to print all even numbers from m to n using pointers, where m and n are any two integers and $m <= n$. (5)

7. (a) Explain the importance of a switch case statement. In which situations is a switch case desirable? Also give its limitations. Write a short note an goto Statement. (4+4=8)

   (b) Write a program to calculate GCD (Greatest Common Divisor) of two numbers. (7)

Total No. of printed pages = 4

CY 181101

Roll No. of candidate

The figures in the margin indicate full marks
for the questions.

Answer Question No. 1 and any *four* from the rest.

Questions No.2 to 7 carries 15 marks each.

1. $(10 \times 1 = 10)$

   (i)   What is the significance of ψ^2?

   (ii)   What is the chemical formula of most common Bucky ball?

   (iii) Define R_f value.

   (iv)   How does polydispersity index (PDI) explain the polydispersity or monodispersity of a polymer.

[Turn over

(v) Name any two solid lubricants.

(vi) Where the electrochemical corrosion takes place?

(vii) Which constituent of cement causes its initial setting?

(viii) Name two green solvents.

(ix) What type of excitation can take place in CH_3COCH_3 at 280nm and 190nm in uv-spectroscopy.

(x) Give two examples of biopolymer.

2. (a) Write schrodinger wave equation for hydrogen atom and explain the different terms involved in it. (3)

(b) Draw the radial probability distribution curves of electron at different radial distance γ from the nucleus for n = 1, l = 0 and n = 2, l = 0 orbitals. (4)

(c) Draw the molecular orbital diagram of CO molecule and calculate the bond order. (4)

(d) The bond order of N_2^+ ion is less than that of N_2 whereas the bond order of O_2^+ is greater than that of O_2. Explain with the help of molecular orbital theory. (4)

3. (a) Explain addition and condensation polymerisation with suitable examples and state the differences between these polymerisation. (6)

(b) Give reasons

(i) PVC is soft and flexible

(ii) Natural rubber need vulcanization. (4)

(c) Give two examples of commercially prepared conducting polymer. How conductivity of a polymer can be increased by doping method?

(2+3=5)

4. (a) What are different types of carbon nano-tubes? Write down the important characteristics and applications of carbon nano-tubes. (5)

(b) Write down the applications of nanomaterials in the field of

(i) medicine

(ii) Catalysis. (5)

(c) State Beer-Lambert law. Explain the following terms in respect of UV-vis spectroscopy with example. (i) Chromophore (ii) Auxochrome

(2+3=5)

5. (a) Write down the major applications of the following (any two)

(i) Infrared spectroscopy

(ii) NMR spectroscopy

(iii) Mass spectroscopy. (4)

(b) What are alternative solvents? Write a note on the following:

(i) Properties of Ionic liquids.

(ii) Advantage of supercritical CO_2 fluid. (6)

(c) What do you mean by

(i) Carbon footpring.

(ii) Carbon sequestration. (2)

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(c) What do you mean by

(i) Carbon footpring.

(ii) Carbon sequestration. (2)

(d) How the solid waste effect the public health of an urban area? (3)

6. (a) What is corrosion? Explain rusting of iron with the help of electrochemical theory of corrosion. (2+4=6)

(b) Describe two methods for protection of a metal from corrosion. (5)

(c) What is Galvenic series? How does it differ from electrochemical series. (4)

7. (a) Give the average chemical composition of portland cement. Explain the setting and hardening of portland cement with chemical reactions involved in it. (2+5=7)

(b) Write characteristic of a good lubricating oil. Name the additive used to improve the following desired quality of lubricating oil. (5)

(i) to prevent rusting

(ii) to improve viscosity index

(iii) to prevent oxidation

(c) What are the refractories? Give two essential properties of a good refractory material. (3)

———————

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(ii) to improve viscosity index

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Total No. of printed pages = 7

MA 181102

Roll No. of candidate

2019

B.Tech. 1st Semester End-Term Examination

MATHEMATICS – I

(New Regulation (w.e.f. 2017 – 2018)) and

(New Syllabus – (Group – A) (w.e.f. 2018 – 2019))

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from
the rest.

1.   (A)·   Choose the appropriate answers :   (8 × 1 = 8)

   (i) $\int_0^{\frac{\pi}{2}} \dfrac{(n-1)(n-3)(n-5)....4.2}{n(n-2)(n-4)....5.3}$ when n is

   (a)   an integer

   (b)   a real number

   (c)   a positive odd number greater than 1

   (d)   an even number not equal to zero

(ii) The volume of solid generated by revolution of area bounded by the curve $r = f(\theta)$ and the radii vectors $\theta = \alpha$, $\theta = \beta$ about the line $\theta = \dfrac{\pi}{2}$ is

(a) $\displaystyle\int_{\alpha}^{\beta} \frac{2}{3}\pi r^3 \sin\theta\, d\theta$

(b) $\displaystyle\int_{\alpha}^{\beta} \frac{2}{3}\pi r^2 \sin\theta\, d\theta$

(c) $\displaystyle\int_{\alpha}^{\beta} \frac{2}{3}\pi r^2 \cos\theta\, d\theta$

(d) $\displaystyle\int_{\alpha}^{\beta} \frac{2}{3}\pi r^3 \cos\theta\, d\theta$

(iii) If $y = e^{ax}$ then n^{th} derivative of y is equal to

(a) $a^n e^{ax}$

(b) a^n

(c) e^{ax}

(d) $\dfrac{e^{ax}}{a^n}$

(iv) $\displaystyle\lim_{x\to 0}\frac{1-\cos x}{\sin x}$ is equal to

(a) 0

(b) 1

(c) −1

(d) 2

(ii) The volume of solid generated by revolution of area bounded by the curve $r = f(\theta)$ and the radii vectors $\theta = \alpha$, $\theta = \beta$ about the line $\theta = \dfrac{\pi}{2}$ is

(a) $\displaystyle\int_{\alpha}^{\beta} \dfrac{2}{3}\pi r^3 \sin\theta\, d\theta$

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(b) a^n

(c) e^{ax}

(d) $\dfrac{e^{ax}}{a^n}$

(iv) $\displaystyle\lim_{x \to 0} \dfrac{1 - \cos x}{\sin x}$ is equal to

(a) 0

(b) 1

(c) −1

(d) 2

(v) If $f(x, y) = 0$ then $\dfrac{dy}{dx}$ is equal to

(a) $\dfrac{\partial f}{\partial x} \Big/ \dfrac{\partial f}{\partial y}$

(b) $\dfrac{\partial f}{\partial y} \Big/ \dfrac{\partial f}{\partial x}$

(c) $-\dfrac{\partial f}{\partial y} \Big/ \dfrac{\partial f}{\partial x}$

(d) $-\dfrac{\partial f}{\partial x} \Big/ \dfrac{\partial f}{\partial y}$

(vi) Which one of the following matrices is a singular matrix?

(a) $\begin{bmatrix} 2 & 3 \\ 5 & 4 \end{bmatrix}$

(b) $\begin{bmatrix} 2 & 4 \\ 3 & 6 \end{bmatrix}$

(c) $\begin{bmatrix} 3 & 2 \\ 3 & 6 \end{bmatrix}$

(d) $\begin{bmatrix} 4 & 3 \\ 6 & 2 \end{bmatrix}$

(vii) If a square matrix has an eigen value λ then the eigen value of $(kA)^T$ where $k \neq 0$ is scalar is

(a) $\dfrac{\lambda}{k}$

(b) $\dfrac{k}{\lambda}$

(c) $k\lambda$

(d) λ^k

(viii) $\displaystyle\int\limits_a^b \int\limits_c^d \int\limits_e^f dz\,dy\,dx$ is equal to

(a) $a+b+c+d+e+f$

(b) $abcdef$

(c) $(b-a)(d-c)(f-e)$

(d) $(a+b)(c+d)(e+f)$

(B) Fill in the blanks : $(2 \times 1 = 2)$

(i) The series $1 + \dfrac{1}{2^{7/5}} + \dfrac{1}{3^{7/5}} + \dfrac{1}{4^{7/5}} + ...$ is _____.

(ii) If n is a positive integer then $\Gamma(n+1) =$ _____.

2. (a) If $f_n = \displaystyle\int\limits_0^{\frac{\pi}{2}} x^n \sin x\,dx$ the show that

$f_n + n(n-1)f_{n-2} = n\left(\dfrac{\pi}{2}\right)^{n-1}$. Hence, evaluate

$\displaystyle\int\limits_0^{\frac{\pi}{2}} x^4 \sin x\,dx$. $(4 + 1 = 5)$

(b) Find the whole area of the curve $a^2y^2 = x^3(2a - x)$. (5)

(c) Find the surface area of the solid of revolution of the asteroid $x = a\cos^3 t$, $y = a\sin^3 t$ about x-axis. (5)

3. (a) If $y = a\cos(\log x) + b\sin(\log x)$ show that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2 + 1)y_n = 0$. (5)

(b) Evaluate (any one) : (2)

    (i) $\lim\limits_{x \to \frac{\pi}{2}} (\sin x)^{\tan x}$

    (ii) $\lim\limits_{x \to \infty} \dfrac{x^4}{e^x}$.

(c) Find Lagrange form of reminder in the expansion of $e^x \cos x$. (4)

(d) Show that radius of curvature of the curve $x^3 + y^3 = 3axy$ at the point $\left(\dfrac{3a}{2}, \dfrac{3a}{2}\right)$ is $\dfrac{-8\sqrt{2}}{3a}$. (4)

4. (a) Test the convergence of the series $\dfrac{1}{\sqrt{1.2}} + \dfrac{1}{\sqrt{2.3}} + \dfrac{1}{\sqrt{3.4}} + \ldots$ to ∞. (4)

(b) Find the Fourier series for the function $f(x) = x - x^2$, $-\pi < x < \pi$. Hence show that $\dfrac{1}{1^2} - \dfrac{1}{2^2} + \dfrac{1}{3^2} - \dfrac{1}{4^2} + \ldots = \dfrac{\pi^2}{12}$. $(6 + 2 = 8)$

(c) Expand $f(x) = 2x - 1$ in a half range sine series in $0 < x < 1$. (3)

(b) Find the whole area of the curve $a^2y^2 = x^3(2a - x)$. (5)

(c) Find the surface area of the solid of revolution of the asteroid $x = a\cos^3 t$, $y = a\sin^3 t$ about x-axis. (5)

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(c) Expand $f(x) = 2x - 1$ in a half range sine series in $0 < x < 1$. (3)

5. (a) State and prove Euler's theorem on homogeneous functions. $(1 + 4 = 5)$

(b) If $Z = f(x, y)$ where $x = e^u \cos v$ and $y = e^u \sin v$ show that $y \dfrac{\partial z}{\partial u} + x \dfrac{\partial z}{\partial v} = e^{2u} \dfrac{\partial z}{\partial y}$. $\quad$ (4)

(c) Find the inverse of the matrix $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ by applying elementary row transformation. (4)

(d) Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 7 \\ 3 & 6 & 10 \end{bmatrix}$. $\quad$ (2)

6. (a) Solve the following system of linear equations $\quad$ (4)

$$2x + 3y + 4z = 11$$
$$x + 5y + 7z = 15$$
$$3x + 11y + 13z = 25$$

(b) Show that the vectors

$X_1 = (1, 0, 2, 1), \quad X_2 = (3, 1, 2, 1), \quad X_3 = (4, 6, 2, -4),$
$X_4 = (-6, 0, -3, -4)$ are linearly dependent. Also find the relation between them. $\quad (4 + 1 = 5)$

(c) Evaluate the following integral by changing the order of integration $\displaystyle\int_0^2 \int_y^2 e^{x^2}\, dx\, dy$. $\quad$ (3)

(d) Evaluate : $\displaystyle\int_0^\infty x^4 e^{-x^2}\, dx$. $\quad$ (3)

5. (a) State and prove Euler's theorem on homogeneous functions. $(1 + 4 = 5)$

   (b) If $Z = f(x, y)$ where $x = e^u \cos v$ and $y = e^u \sin v$

   show that $y \dfrac{\partial z}{\partial u} + x \dfrac{\partial z}{\partial v} = e^{2u} \dfrac{\partial z}{\partial y}$. (4)

   (c) Find the inverse of the matrix $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$

   by applying elementary row transformation. (4)

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7. (a) Evaluate : $\iiint \dfrac{dx\,dy\,dz}{(x+y+z+1)^3}$ over the region bounded by the co-ordinate planes and the plane $x+y+z=1$. (5)

   (b) Find all the stationary points of the function $f(x,y)=x^3+y^3+3xy$. Also examine for the maximum and minimum values of $f(x,y)$. (5)

   (c) Verify Cayley – Hamilton theorem for the matrix (5)

   $$A = \begin{bmatrix} 4 & 3 & 1 \\ 2 & 1 & -2 \\ 1 & 2 & 1 \end{bmatrix}$$

MA 181102

CE 181103

Roll No. of candidate

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2019

B.Tech. 1st Semester End-Term Examination

ENGINEERING GRAPHICS AND DESIGN

(New Regulation) (w.e.f. 2017-18) and
(New Syllabus) – (Group B) (w.e.f. 2018-19)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following :

                                            (10 × 1 = 10)

    (i) Representative Fraction (RF) is defined as

        (a) length of an object in the drawing / actual length of the object

        (b) length of an object in the drawing / isometric length the object

        (c) actual length of the object / length of an object in the drawing

        (d) isometric length the object / length of an object in the drawing

[Turn over

(ii) A point 'P' in above H.P. and behind V.P. the point is in

    (a) 1st quadrant

    (b) 2nd quadrant

    (c) 3rd quadrant

    (d) 4th quadrant

(iii) When the line in parallel to V.P. and perpendicular to H.P. we can get its true length in

    (a) front view

    (b) top view

    (c) both top view and front view

    (d) none

(iv) A circle will appear on an isometric drawing as an

    (a) parabola

    (b) cycloid

    (c) ellipse

    (d) circle

(v) The isometric axis are inclined at ———— degree to each other.

    (a) 60

    (b) 90

    (c) 120

    (d) 150

4. (a) Show by means of traces, each of the following planes : (3 × 2 = 6)

   (i) perpendicular to the H.P. and the V.P.

   (ii) perpendicular to the H.P. and inclined at 30° to the V.P.

   (iii) parallel to and 40 mm away from the V.P.

   (b) A line PQ, 90 mm long, is inclined at 45° to the H.P. and its top view makes an angle of 60° with the V.P. The end P is in the H.P. and 12 mm in front of the V.P.

   Draw its front view and find its true inclination with the V.P. (9)

5. Draw an ellipse by "concentric circle method" and find the length of the minor axis with the help of the following data : (15)

   (a) Major axes = 100 mm

   (b) Distance between foci 80 mm.

6. A square plate of side 60 mm is held on a corner on H.P. with a diagonal horizontal and inclined at 45° to V.P. The plate is seen as a Rhombus in a plane with other diagonal measured at 30 mm. Draw the projection of plate and determine the angle with which is makes with H.P. (15)

7. (a) Draw the projections of a square pyramid, side of base 30 mm and axis is 60 mm long. The pyramid is 15 mm above H.P. and 15 mm behind V.P. with its axis vertical and two sides of its base parallel to V.P. (7)

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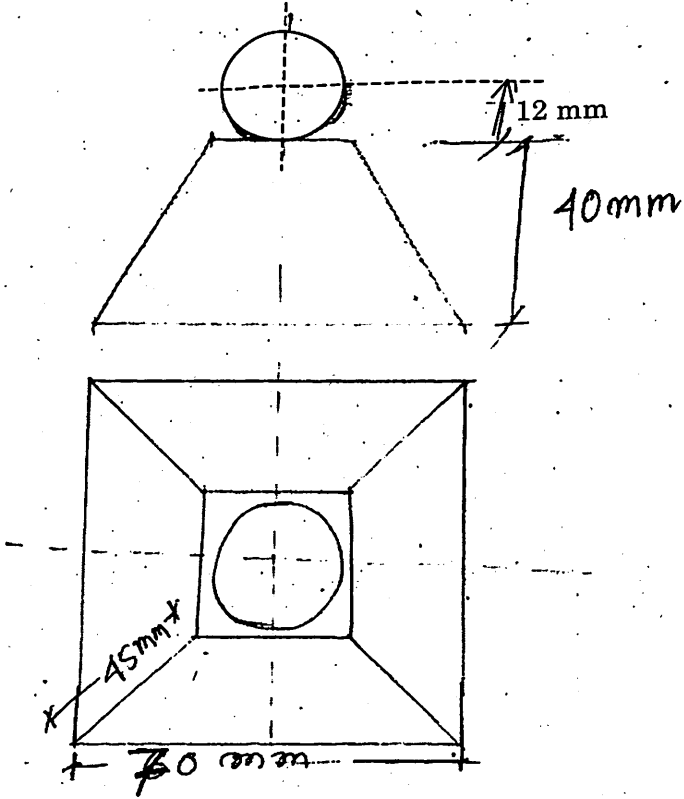(a) Major axes = 100 mm

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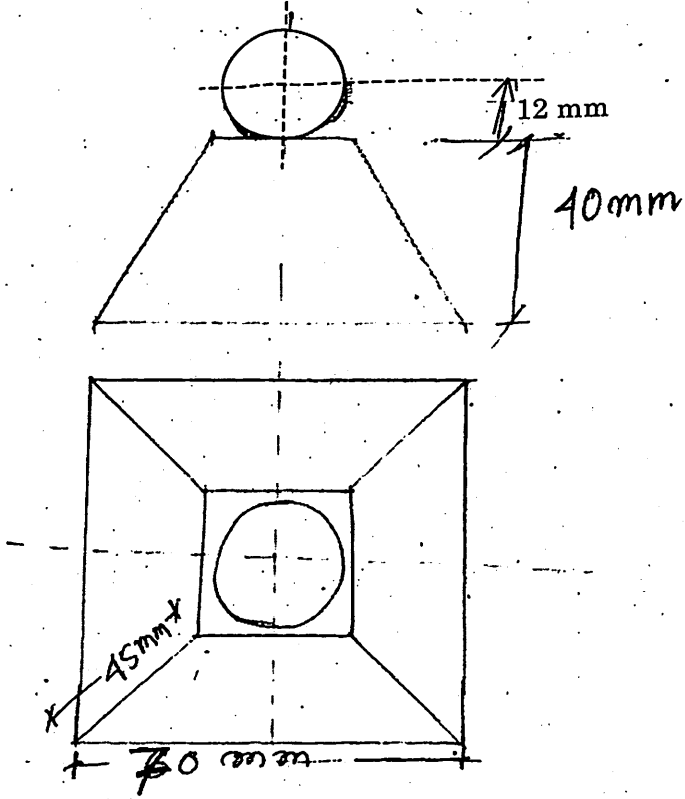
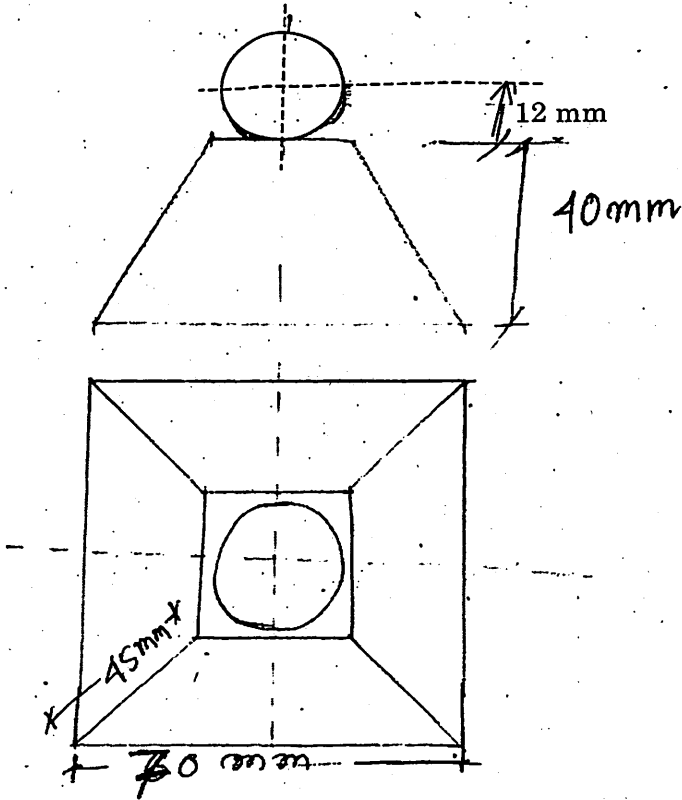(b)   Draw the isometric view.   (8)

12 mm

40mm

45mm

70 mm

(b) Draw the isometric view. (8)

12 mm

40mm

45mm

30 mm

(b)   Draw the isometric view.   (8)

12 mm

40mm

45mm

30 mm

16 (MA-103) MAT (O)

2019 C

MATHEMATICS-I

(Old Syllabus)

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

GROUP-A

(Differential Calculus)

*Answer **any six** questions from this **Group :***
$6 \times 5 = 30$

1. Find the nth derivative of : $2\frac{1}{2} + 2\frac{1}{2} = 5$

    (i) $\cos x \cos 2x \cos 3x$

    (ii) $e^{2x} \cos^2 x \sin x$.

2. If $\log y = \tan^{-1} x$, show that

    $(1 + x^2) y_{n+1} + 2nx y_n + n(n-1) y_{n-1} = 0$. 5

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Contd.

13. Find the length of the astroid

   $x = a \cos^3 \theta,\ y = a \sin^3 \theta$. 5

14. Find the volume of a sphere of radius 'a'. 5

15. Find the surface area of the ellipsoid formed by revolution of the ellipse

   $x^2/a^2 + y^2/b^2 = 1$, round its major axis. 5

16. Find the area bounded by the parabolas

   $y^2 = 9x$ and $x^2 = 9y$. 5

GROUP-C

(Differential Equations)

Answer **any two** questions from this **Group** : 2×14=28

17. Solve :

   (a) $\left(x^2 - y^2\right) dx + 2xy\, dy = 0$ 4

   (b) $\dfrac{dy}{dx} + y \tan x = \cos^2 x$ 5

   (c) $\dfrac{dy}{dx} + \dfrac{y}{x} = y^2$ 5

18. Solve :

(a) $(1 + xy)y\,dx + (1 - xy)x\,dy = 0$ 5

(b) $p(p + x) = y(x + y)$, where $p = \dfrac{dy}{dx}$ 4

(c) $(D^3 + 1)y = \cos(2x - 1)$ 5

19. Solve :

(a) $\dfrac{d^2y}{dx^2} - 3\dfrac{dy}{dx} + 2y = e^{5x}$ 4

(b) $x^2\dfrac{d^2y}{dx^2} - 2x\dfrac{dy}{dx} - 4y = x^4$ 5

(c) $(D - 2)^2 = 8\left(e^{2x} + \sin 2x + x^2\right)$ 5

GROUP-D

(Vector Algebra)

*Answer **any three** questions :*   3×4=12

20. (a) Show that, $\left[\vec{a} + \vec{b},\ \vec{b} + \vec{c},\ \vec{c} + \vec{a}\right] = 2\left[\vec{a}, \vec{b}, \vec{c}\right]$

     4

(b) Find the volume of the tetrahedron formed by the points $(1, 1, 1)$, $(2, 1, 3)$, $(3, 2, 2)$ and $(3, 3, 4)$.   4

(c) Show that,

$$\hat{i} \times (\bar{a} \times \hat{i}) + \hat{j} \times (\bar{a} \times \hat{j}) + \hat{k} \times (\bar{a} \times \hat{k}) = 2\bar{a}$$ 4

(d) Prove that,

$$\left[\bar{B} \times \bar{C}, \ \bar{C} \times \bar{A}, \ \bar{A} \times \bar{B} \right] = \left[\bar{A} \bar{B} \bar{C} \right]^2$$ 4