SYLLABUS BREAKDOWN SCHEME FOR MATH123
DAE FIRST YEAR EXAMINATION 2011 & ONWARD

Common with Electrical, Instrument, Food, Computer, Electronics, Computer Information, Telecommunications and Bio-Medical Technologies

PAPER A				
Sr. No.	Contents	MCQs	Short Questions	Long Questions
1	Quadratic Equations	3	5	1
2	Binomial Theorem	3	5	1
4	Fundamentals of Trigonometry	6	12	2
5	Trigonometric Functions and Ratios			
6	General Identities			
7	Solution of Triangles			
8	Vectors & Phasors	3	5	1
	TOTAL	**15**	**27**	**5**
PAPER B				
3	Partial Fractions	2	4	1
9	Complex Numbers	3	5	1
10	Boolean Algebra & Gate Networks	3	5	1
11	Plane Analytic Geometry & Straight Line	5	9	1
12	Equations of the Straight Line			
13	Equations of the Circle	2	4	1
	TOTAL	**15**	**27**	**5**

MARKS BREAKDOWN SCHEME FOR APPLIED MATHEMATICS - I				
PAPER	Objective	Subjective		Total Marks
		Section I: Short Questions	Section II: Long Questions	
A	15	36	24	**75**
B	15	36	24	**75**
			GRAND TOTAL	**150**

NOTE:

1. Objective paper consists of 15 MCQs of 1 mark each.

2. Subjective portion consists of two sections:
   Section-I contains 27 short questions out which 18 will be solved of 2 marks each.
   Section-II contains 5 long questions out of which 3 will be solved of 8 marks each.

3. In Section-II, each long question consists of two parts of 4 marks each.

MODEL PAPER MATH123: APPLIED MATHEMATICS – I
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Roll No. _____
Signature of Candidate: _____
Signature of Deputy Supdt. _____

PAPER A: OBJECTIVE

Time: 30 Minutes **Marks:** 15

Note: Write your Roll Number in the space provided. Over-writing, Cutting, Erasing, Using lead pencil will result in loss of marks.

Q.No. 1. Each question has four possible answers. Choose the correct answer and encircle it

(i) The sum of roots of equation $ax^2 + bx + c = 0$ is equal to:
(a) b/a (b) – b/a (c) c/a (d) – c/a

(ii) The discriminant of quadratic equation is:
(a) $b^2 - 4ac$ (b) $\sqrt{b^2 - 4ac}$ (c) $b^2 + 4ac$ (d) $\sqrt{b^2 + 4ac}$

(iii) If $x^2 - 3 = 0$ then the solution set is
(a) {3, -3} (b) $\{-3, \sqrt{3}\}$ (c) $\{-\sqrt{3}, 3\}$ (d) $\{\sqrt{3}, -\sqrt{3}\}$

(iv) The value of ${}^8C_4$ is equal to
(a) 70 (b) 32 (c) 4 (d) 12

(v) Vectors $\underline{a}$ and $\underline{b}$ are perpendicular if
(a) $\underline{a} \times \underline{b} = \underline{0}$ (b) $\underline{a} \cdot \underline{b} = 0$ (c) $\underline{a} \times \underline{b} = 1$ (d) $\underline{a} \cdot \underline{b} = 1$

(vi) In binomial theorem, the general term in the expansion of $(a + b)^n$ is:
(a) ${}^nC_r\, a^{n-r}\, b^r$ (b) ${}^nC_r\, a^{n+r}\, b^r$ (c) ${}^nC_r\, a^n\, b^{n-r}$ (d) ${}^nC_r\, a^r\, b^{n-r}$

(vii) The number of terms in the expansion of $(x + y)^{24}$ is:
(a) 23 (b) 24 (c) 25 (d) 12

(viii) The magnitude of vector $2\underline{i} - 2\underline{j} - \underline{k}$ is equal to:
(a) 1 (b) 2 (c) 3 (d) 4

(ix) The vector perpendicular to each of the vectors $\underline{a}$ and $\underline{b}$ is:
(a) $\underline{a} \times \underline{b}$ (b) $\underline{a} \cdot \underline{b}$ (c) $\underline{a} + \underline{b}$ (d) $\underline{a} - \underline{b}$

(x) If $\sin\theta < 0$ and $\cos\theta > 0$ then the angle lies in the quadrant:
(a) I (b) II (c) III (d) IV

(xi) In radian measure, the angle of 1° is equal to:
(a) 0.01745 rad (b) 0.17450 rad (c) 0.001745 rad (d) 1.7450 rad

(xii) The trigonometric function $\sec^2\theta$ is equal to:
(a) $1 - \tan^2\theta$ (b) $1 + \tan^2\theta$ (c) $1 - \cot^2\theta$ (d) $1 + \cot^2\theta$

(xiii) $\cos(270 + \theta)$ is equal to
(a) $\cos\theta$ (b) $-\cos\theta$ (c) $\sin\theta$ (d) $-\sin\theta$

(xiv) $2\sin^2\theta$ is equal to
(a) $1 - \cos2\theta$ (b) $1 + \cos2\theta$ (c) $1 - \cos\theta$ (d) $1 + \cos\theta$

(xv) If one angle of right triangle is 45° then the other angle is:
(a) 30° (b) 45° (c) 60° (d) 135°

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PAPER A: SUBJECTIVE

Time: 2 hours 30 Minutes **Marks:** 60

Note: Solve any **EIGHTEEN (18)** questions from Section-I and any **THREE (3)** questions from Section-II

SECTION – I

Q.No. 2. Write short answers to any **EIGHTEEN (18)** from the following questions. **(18 x 2 = 36)**

(i) Solve the equation $(2x + 3)(x + 1) = 1$
(ii) Solve $32 - 3x^2 = 10x$ by the method of completing square
(iii) Find the nature of the roots of the equation $3x^2 + 7x - 2 = 0$
(iv) Without solving, find the sum and product of roots of the equation $x^2 - 9 = 0$
(v) Form the quadratic equation whose roots are $2 + \sqrt{3}$ and $2 - \sqrt{3}$
(vi) Expand $(x + 1/x)^4$ by using Binomial theorem
(vii) By using Binomial formula, compute $(0.98)^6$ to two decimal places.
(viii) Find the fifth term of the binomial expression $(x - y)^{10}$
(ix) Using the Binomial Series, calculate $\sqrt{40}$, to the nearest hundredth.
(x) Write and simplified first three terms in the expansion of $(1 + x)^{-3}$
(xi) Find real numbers x, y, z such that $x\underline{i} + 2y\underline{j} - z\underline{k} + 3\underline{i} - \underline{j} = 4\underline{i} + 3\underline{k}$
(xii) Find the vector $\overrightarrow{AB}$, if the position vectors of A and B are $5\underline{i} - 2\underline{j} + 4\underline{k}$ and $\underline{i} + 3\underline{j} + 7\underline{k}$ respectively.
(xiii) For what value of λ, the vectors $2\underline{i} - \underline{j} + 2\underline{k}$ and $3\underline{i} + 2\lambda\underline{j}$ are perpendicular?
(xiv) Find $\underline{a} \times \underline{b}$ if vector $\underline{a} = 2\underline{i} + 3\underline{j} + 4\underline{k}$ and vector $\underline{b} = \underline{i} - \underline{j} + \underline{k}$
(xv) Find the unit vector along the vector $4\underline{i} - 3\underline{j} - 5\underline{k}$
(xvi) What is the length of an arc of a circle of radius 5 cm whose central angle is of 140°?
(xvii) Find $\cos\theta$ if $\sin\theta = 7/25$ and angle θ is an acute angle.
(xviii) Prove the trigonometric identity: $\tan\theta + \cot\theta = \sec\theta.\operatorname{cosec}\theta$
(xix) Prove that $\sqrt{3}\cos\theta - \sin\theta = 2\cos(\theta + 30°)$
(xx) If $\cos\theta = -5/13$ and the terminal side of angle θ is in the second quadrant, find the value of $\sin\theta/2$.
(xxi) Express $\cos 12\theta - \cos 4\theta$ as a product of trigonometric functions.
(xxii) In right triangle ABC, $\gamma = 90°$, $a = 5$, $c = 13$ then find the value of angle α.
(xxiii) Find the distance of man from the foot of the tower 100m high if the angle of elevation of its top as observed by the man is 52° 30'.
(xxiv) In any triangle ABC: $b = 7$, $\alpha = 40°$, $\beta = 22°$. Find the value of side a.
(xxv) In any triangle ABC, find the value of angle β if $a = 13$, $b = 10$ and $c = 17$.
(xxvi) Express $\sin 3\theta.\cos 5\theta$ as sum or difference of trigonometric functions.
(xxvii) Verify that $\sin^2 30° + \sin^2 60° + \tan^2 45° = 2$

SECTION – II

Note: Solve any THREE (3) questions. **(8 x 3 = 24)**

Q.3(a) Solve: $\dfrac{1}{a+b+x} = \dfrac{1}{a} + \dfrac{1}{b} + \dfrac{1}{x}$

(b) Show that the equation $x^2 + (mx + c)^2 = a^2$ has equal roots if $c^2 = a^2(1 + m^2)$

Q.4(a) Find the term independent of x in the expansion of $(2x^2 - 1/x)^{12}$

(b) Find the value of: $(x + y)^5 + (x - y)^5$

Q.5(a) Show that $[\cos(\alpha + \beta)][\cos(\alpha - \beta)] = \cos^2\alpha - \sin^2\beta$

(b) Prove that $\operatorname{Sec}^2\theta + \tan^2\theta = (1 - \operatorname{Sin}^4\theta)\operatorname{Sec}^4\theta$

Q.6(a) Prove that $\sin 20°.\sin 40°.\sin 60°.\sin 80° = 3/16$

(b) Solve the Δ ABC when $\gamma = 90°$, $a = 250$, $\alpha = 42° 25'$

Q.7(a) Find the unit vector perpendicular to both $\underline{a} = \underline{i} + \underline{j} + \underline{k}$ and $\underline{b} = 2\underline{i} + 3\underline{j} - \underline{k}$

(b) Find the cosine of the angle between the vectors:

$\underline{a} = 3\underline{i} + \underline{j} + 2\underline{k}$, $\underline{b} = 2\underline{i} - 2\underline{j} + 4\underline{k}$

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PAPER B: OBJECTIVE

Time: 30 Minutes **Marks:** 15

Note: Write your Roll Number in the space provided. Over-writing, Cutting, Erasing, Using lead pencil will result in loss of marks.

Q.No. 1. Each question has four possible answers. Choose the correct answer and encircle it.

(i) The numbers of partial fractions of $(3x-5)/(x^4-1)$ are:

(a) 1 (b) 2 (c) 3 (d) 4

(ii) If degree of P(x) is less than degree of Q(x) then P(x)/ Q(x) is called

(a) Proper Fraction (b) Improper Fraction (c) Polynomial (d) Identity

(iii) The additive inverse of a + ib is:

(a) a + ib (b) a - ib (c) -a + ib (d) -a - ib

(iv) The multiplicative identity of complex number is:

(a) i (b) 1 (c) 0 (d) None of these

(v) Modulus of 4 – 3i is:

(a) 5 (b) $\sqrt{7}$ (c) 1 (d) 7

(vi) Binary equivalent of decimal number 9 is:

(a) $(1001)_2$ (b) $(1010)_2$ (c) $(0101)_2$ (d) $(0110)_2$

(vii) In Boolean Algebra $\overline{X+Y}$ is equal to

(a) $\overline{X}+\overline{Y}$ (b) $\overline{X}\,.\,\overline{Y}$ (c) X + Y (d) X . Y

(viii) In Boolean Algebra X.X is equal to

(a) 1 (b) 0 (c) X + X (d) X

(ix) Distance between (4,3) and (7,5) is:

(a) 25 (b) 13 (c) $\sqrt{13}$ (d) 5

(x) The point (5, -4) lies in the quadrant

(a) I (b) II (c) III (d) IV

(xi) If two lines are perpendicular then relation between their slopes m_1 and m_2 is:

(a) $m_1 = m_2$ (b) $m_1 . m_2 = -1$ (c) $m_1 = 1/m_2$ (d) $m_1 + m_2 = -1$

(xii) x-intercept of line 3x + 4y -12 =0 is:

(a) 3 (b) 4 (c) 1 (d) 12

(xiii) The equation of line parallel to y-axis is

(a) x = a (b) y = a (c) x = y (d) x = – y

(xiv) Radius of circle $x^2 + y^2 - 25 = 0$ is

(a) 5 (b) -5 (c) 25 (d) -25

(xv) Centre of the circle $x^2 + y^2 - 2x - 4y = 8$ is

(a) (2 , 4) (b) (-2 , -4) (c) (1 , 2) (d) (-1 , -2)

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PAPER B: SUBJECTIVE

Time: 2 hours 30 Minutes **Marks:** 60

Note: Solve any **EIGHTEEN (18)** questions from Section-I and any **THREE (3)** questions from Section-II

SECTION – I

Q.No. 2. Write short answers to any **EIGHTEEN (18)** from the following questions. **(18 x 2 = 36)**

(i) Resolve into partial fractions $2x/(x-2)(x+5)$

(ii) Define rational proper fraction and give example.

(iii) Write an identity equation of $8x^2/(1-x^2)(1+x^2)^2$

(iv) Resolve into partial fractions $1/(x^2-x)$

(v) Add and subtract the complex numbers $3 + 4i$ and $2 - 7i$

(vi) Divide $3 + 4i$ by $2-7i$ and write answer in the form $a + ib$

(vii) Fractorize $49a^2 + 625\ b^2$

(viii) Write complex number $-1 + i\sqrt{3}$ in the polar form

(ix) Find complex number z when $|z| = 8\sqrt{2}$ and $\arg z = \pi/4$

(x) Prove by Boolean rules the logical equation $X + Y.Z = (X + Y)(X + Z)$

(xi) Prove that $\overline{A + B} = \overline{A} \cdot \overline{B}$ by truth table

(xii) Draw a logic circuit diagram for $A.(B + \overline{C})$

(xiii) Define NAND gate in logic circuit diagram

(xiv) Prepare a truth table for $AB + \overline{A}\,\overline{B}$

(xv) Find distance between A $(1 - \sqrt{2}, 1 - \sqrt{3})$ and $(1 + \sqrt{2}, 1 + \sqrt{3})$

(xvi) Is the point (0 , 4) inside or out side the circle of radius 4 with centre at (-3 , 1)?

(xvii) Find the coordinates of the midpoint of the line segment A (3,7) and B (-2,3)

(xviii) Obtain the ratio in which the point (3, -2) divides the line formed by (1,4) and (-3,16)

(xix) Find an equation of the line with slope 2/3 and having y-intercept 3.

(xx) Find k if the two lines $5x - 3y = 12$ and $kx - y = 2$ are parallel.

(xxi) Write $3x + 4y - 10=0$ in slope intercept form.

(xxii) Show that the points (1,9), (-2,3) and (-5,-3) are callinear.

(xxiii) Show that the line contain (0,-7) , (8, -5) and the line contain (5,7), (8,-5) are perpendicular.

(xxiv) Find the equation of the circle with centre at (-2,3) and radius 6.

(xxv) Find centre and radius of circle $x^2 + y^2 - 4x + y - 1 = 0$

(xxvi) Find the equation of circle centered at the origin and radius $\sqrt{2}$.

(xxvii) What type of the circle is represented by $x^2 + y^2 - 2x + 4y + 8 = 0$

SECTION – II

Note: Solve any THREE (3) questions. **(8 x 3 = 24)**

Q.3 (a) Resolve into partial fractions $1 / (x^3-1)$

(b) Resolve into partial fractions $(6x+27) / (4x^3-9x)$

Q.4 (a) Extract the square roots of $8 - 6i$

(b) Reduce $(2 + i)(1 - i) / (4 - 3i)$ to the form $a + ib$

Q.5 (a) Convert the binary number $(10101101)_2$ to the octal equivalent.

(b) Prove $(A+B)(\overline{A} + C)(B +C) = (A +B)(\overline{A} + C)$ by constructing truth table.

Q.6 (a) Show tht the points A (2,2), B (6,6) and C (11,1) are the vertices of a right triangle.

(b) Find the equation of the perpendicular bisector of line segment joing the points (-4,6) and (6,-10).

Q.7 (a) Find the equation of circle passing through the points (0, 1) , (3, -3) and (3, -1).

(b) Find the equation of the circle having (-2,5) and (3,4) as the end points of its diameter.