SYLLABUS BREAKDOWN SCHEME FOR MATH113
DAE FIRST YEAR EXAMINATION 2011 & ONWARD

Common with Civil, Mechanical, Auto-Diesel, Auto-Farm, Printing & Graphic Arts, RAC, Foundry & Pattern Making, Welding & Metallurgy, Automation, Chemical, Textile, Petroleum, Petro-Chemical

PAPER A				
Sr. No.	Contents	MCQs	Short Questions	Long Questions
1	Quadratic Equations	2	3	1
2	Arithmetic Progression & Series	3	6	1
3	Geometric Progression and Series			
4	Binomial Theorem	3	6	1
5	Partial Fractions			
6	Fundamentals of Trigonometry	7	12	2
7	Trigonometric Functions and Ratios			
8	General Identities			
9	Solution of Triangles			
	TOTAL	**15**	**27**	**5**
PAPER B				
10	Mensuration of Solids	9	17	3
11	Vectors	3	5	1
12	Matrices & Determinants	3	5	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 20%	36 (60% of 30)	24 (40% of 30)	**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.

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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) The arithmetic mean between a – x and a + x is equal to:
(a) $a^2 - x^2$ (b) 2a (c) a (d) a/2

(iv) If x, y, z are in geometric progression then the relation between them is:
(a) $y^2 = xz$ (b) $y = (x + z)/2$ (c) $y = xz$ (d) $y = z/x$

(v) If first term is "a" and common difference is "d" the the nth term of an A.P. is:
(a) a + (n + 1)d (b) a – (n + 1)d (c) a + (n – 1)d (d) a – (n – 1)d

(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 number of partial fractions of $\frac{3x - 5}{x^4 - 1}$ are:
(a) 1 (b) 2 (c) 3 (d) 4

(ix) The relation between the arc-length l, radius r and central angle θ in radian is:
(a) $l = r/\theta$ (b) $l = \theta/r$ (c) $\theta = l/r$ (d) $\theta = r/l$

(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) $1 - \cos 2\theta$ (b) $1 + \cos 2\theta$ (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) Form the quadratic equation whose roots are $3 + \sqrt{5}$ and $3 - \sqrt{5}$
(ii) Solve $32 - 3x^2 = 10x$ by quadratic formula
(iii) Find the nature of the roots of the equation $3x^2 + 7x - 2 = 0$
(iv) Insert two arithmetic means between – 5 and 40
(v) Sum the arithmetic series 3+11+19+- - - - - to 16 terms
(vi) Find the 7th term of A.P. in which the first term is 7 and the common difference is – 3.
(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) Find geometric mean between 8 and 72
(xi) Sum the geometric series 1 + 1/3 + 1/9 + - - - - - - - to 6 terms
(xii) At 4% compounded annually, find the compounded amount of Rs. 1000 at the end of 7 years.
(xiii) Resolve into partial fractions $2x / (x-2)(x+5)$
(xiv) Define rational improper fraction and give example
(xv) Write an identity equation of $8x^2 / (1 - x^2)(1 + x^2)^2$
(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 $\cos12\theta - \cos4\theta$ 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 $\sin3\theta.\cos5\theta$ 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 the quadratic equation $x^2 + (m - n)x - 2(m - n)^2 = 0$
(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 20th term of an A.P. whose 3rd term is 7 and the 8th term is 17.
(b) If $S_6 = 665/144$ and $r = 2/3$ then find the first term of a geometric sequence.

Q.5(a) Resolve into partial fractions: $1 / x^4(x + 1)$
(b) Find the term independent of x in the expansion of $(2x^2 - 1/x)^{12}$

Q.6(a) Prove that $\sin20°.\sin40°.\sin60°.\sin80° = 3/16$
(b) Prove the identity $\sec^2\theta + \tan^2\theta = (1 - \sin^4\theta)\sec^4\theta$

Q.7(a) Show that $[\cos(\alpha + \beta)][\cos(\alpha - \beta)] = \cos^2\alpha - \sin^2\beta$
(b) Solve the Δ ABC when $\gamma = 90°$, $a = 250$, $\alpha = 42° 25'$

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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) Plane figures are those which occupy area with only
(a) Two Dimension (b) Three Dimensions (c) 4 Dimensions (d) None of these

(ii) A Prism with polygonal base is known as
(a) Circular Prism (b) Cubical Prism (c) Polygonal Prism (d) None of these

(iii) Volume of circular cylinder of height "h" and radius "r" is
(a) $\pi r^2 h$ (b) $2\pi rh$ (c) $2\pi rh^2$ (d) $2\pi r^2 h$

(iv) It area of base of pyramid is "A" and height "h" then volume of pyramid is
(a) 1/3 Ah (b) 1/2Ah (c) 1/6 Ah (d) Ah

(v) Volume of a cone of height "h" and base radius "r" is
(a) $1/3\pi r^2 h$ (b) $1/3\pi rh$ (c) $\pi r^2 h$ (d) $1/2\pi r^2 h$

(vi) Surface area of sphere of radius "r" is
(a) $4\pi r^2$ (b) $4\pi r^3$ (c) πr^2 (d) $4/3\pi r^2$

(vii) The portion of the prism between the plane section and its base is called
(a) Annulus (b) Frustum (c) Ring (d) None of these

(viii) If R and r are the external and internal radii of spherical shell respectively then its volume is
(a) $4/3\pi(R^3 - r3)$ (b) $4/3\pi(R^2 - r^2)$ (c) $4\pi(R^3 - r^2)$ (d) $\pi/3(R^3 - r^3)$

(ix) A prism whose length breadth and height are equal is
(a) Cube (b) Frustum (c) Cylinder (d) None of these

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

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

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

(xiii) Matrix A is called singular if
(a) $|A| = 0$ (b) $|A| \neq 0$ (c) $|A| = 1$ (d) $|A| \neq 1$

(xiv) In an identity matrix all the diagonal elements
(a) zeroes (b) 2 (c) 1 (d) None of these

(xv) The order of the matrix [1 2 3] is:
(a) 1 x 3 (b) 3 x 1 (c) 1 x 1 (d) 3 x 3

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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) Define plane figures.
(ii) Define circumscribed circle.
(iii) If the perimeter of a square is 40cm find the area of the square.
(iv) Write the formula of area of rhombus when two diagonals are given.
(v) Write the formula of area of regular polygon of n sides when length of a side "a" is given.
(vi) Define concentric circles
(vii) Volume of the cube is 95 cu. cm. Find the surface area and the edge of the cube.
(viii) The dimensions of rectangular prism are 6m, 4m, 3m respectively. Find the volume and surface area of the rectangular prism.
(ix) The curved surface area of a circular cylinder is 1000 sq.m. and diameter of the base is 20m. Find the volume and height of the cylinder.
(x) The diameter of right circular cylinder is 38cm and its length is 28 cm. Find its total surface area.
(xi) Find the volume of a pyramid whose base is an equilateral triangle of side 1m and whose height is 4m.
(xii) Write the formula of volume of a cone.
(xiii) Find the total surface area of a cone of radius 6.6 cm and height of 12.5 cm.
(xiv) The diameter of a sphere is 13.5 m. Find its surface area and volume.
(xv) Write the formula for Simpson's rule and describe when we use it.
(xvi) Write down the definition of right prism.
(xvii) Write the formula for the volume of hollow spherical shell.
(xviii) Find the real numbers x, y, z such that $x\underline{i} + 2y\underline{j} - z\underline{k} + 3\underline{i} - \underline{j} = 4\underline{i} + 3\underline{k}$
(xix) Find the vector AB, if the position vectors of A and B are $5\underline{i} - 2\underline{j} + 4\underline{k}$ and $\underline{i} + 3\underline{j} + 7\underline{k}$
(xx) 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?
(xxi) Find $\underline{a} \times \underline{b}$ if vectors $a = 2\underline{i} + 3\underline{j} + 4\underline{k}$ and $\underline{b} = \underline{i} - \underline{j} + \underline{k}$.
(xxii) Find the unit vector along the vector $4\underline{i} - 3\underline{j} - 5\underline{k}$.
(xxiii) Define transpose of a matrix.
(xxiv) Show that $(A+B)^2 \neq A^2 + 2AB + B^2$ when A and B are square matrices.
(xxv) Find x if matrix $A = \begin{bmatrix} x & 3 \\ 4 & 1 \end{bmatrix}$ is singular.
(xxvi) Let $A = \begin{bmatrix} 7 & -3 \\ 2 & 1 \end{bmatrix}$ then find its inverse.
(xxvii) Define identity matrix with respect to multiplication.

SECTION – II

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

Q.3 (a) Use cramer's rule to solve.

$$\begin{aligned} 2x + 2y + z &= 1 \\ x - y + 6z &= 21 \\ 3x + 2y - z &= -4 \end{aligned}$$

(b) Show that: $\begin{vmatrix} \ell & a & a \\ a & \ell & a \\ a & a & \ell \end{vmatrix} = (2a + \ell)(\ell - a)^2$

Q.4 (a) The sides of triangular prism are 17cm, 25cm, and 28cm respectively. The volume of the prism is 4200 cu.cm. What is its height?

(b) Three sides of a triangle are 4.25, 4.50 and 4.75 meters respectively. It we consider 3.25m instead of 4.25m by mistake, what will be the error in computing the area of the triangle.

Q.5 (a) A rectangular piece of iron sheet 1000 sq.cm. in area is bent to form a cylinder 31.89 cm. in diameter. Find the height and volume of this cylinder.

(b) A regular octagon circumscribes a circle of radius 2cm. Find the area of octagon.

Q.6 (a) A pyramid in a square base has every edge 100dm long. Find the edge of a cube of equal volume.

(b) A lead bar of length 10cm width 5cm thickness 4cm is melted down and made in five equal spherical bullets. Find the radius of each bullet.

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

(b) Find the cosine of the angle between the vectors $\underline{a} = 3\underline{i} + \underline{j} + 2\underline{k}$ and $b = 2\underline{i} + 2\underline{j} - 4\underline{k}$