STRICTLY BASED ON THE LATEST SYLLABUS ISSUED
BY DEPARTMENT OF PRE-UNIVERSITY EDUCATION, KARNATAKA

FOR MARCH
2018
EXAM

OSWAAL BOOKS
LEARNING MADE SIMPLE

KARNATAKA PUE

CHAPTERWISE / TOPICWISE

SOLVED PAPERS

2011 - 2017

With Topper's Answers of 2016 Exam

II PUC

MATHEMATICS

Strictly as per the latest syllabus prescribed by
Department of Pre-University Education, Karnataka

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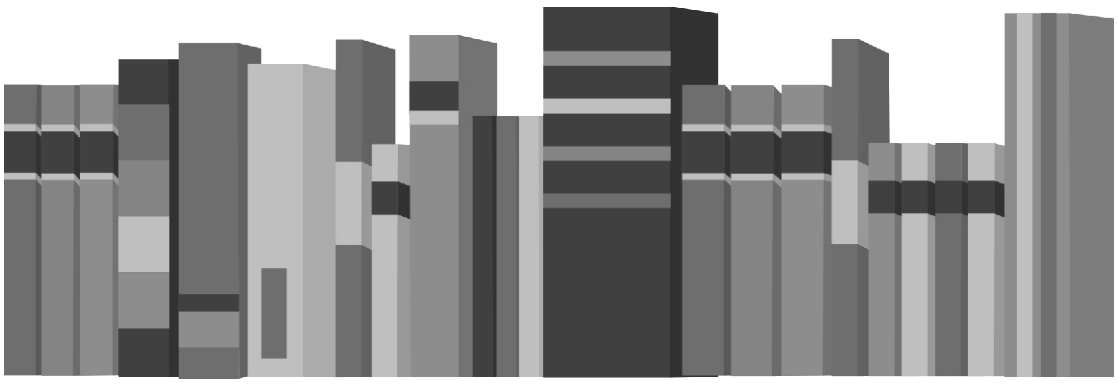

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PREFACE

Malcolm Forbes said "Education's purpose is to replace an empty mind with an open one" and this is something which is always followed by Diretorate of Pre-University Education whether through their education system framework or regular enhancement in curriculum. The aim of the Curriculum is not just to let learners obtain basic knowledge but to make them life-long learners.

The purpose of this book is to nurture individuality and thus enhance one's innate potentials which help in increasing the self-study mode for students. This book strengthens knowledge and attitude related to subject. This book is designed in such a way that students can set their own goals and can improve their problem solving and thinking skills.

This book is strictly as per the latest blueprint & syllabus for II PUC examination. It contains variety of questions from textbooks. It contains all types of questions necessary for exam oriented preparation. A synopsis is given for every chapter which contains important points from that chapter. Each chapter has high quality figures wherever required for better, fast and clear understanding.

OSWAAL II PUC Question Bank is different and better in terms of High Quality Questions which are developed by 'OSWAAL Expert Panel' which ensures success in examination. The Question Bank is arranged 'Topic-Wise' where each topic from every chapter is explained in detail. 'SCHEME OF VALUATION' answer are highlighted to develop student understanding of Marking scheme. It also adheres to the blueprint which enables exam oriented preparation.

Through OSWAAL Books students are taught how to think, not what to think. We at OSWAAL Books try to use quality content, standard language, creativity and high quality figures, which makes readers to enjoy it because we believe if our readers don't enjoy reading our book then there is no use in reading it at all. This is one of the reasons that the scope of this book extends from students to teachers. Teachers can use this book as a perfect teaching guide and students can use this book for good learning and practice.

At last we would like to thank our authors, editors, reviewers and specially students whom we request to send suggestions regularly which will help in continuous improvement of this book and will make this book "One of the Best". Wish you all Happy Learning.

–Publisher

Why Topic Wise Question Banks Are A Better Choice than Previous Year's Papers ?

Question Bank	Previous Years' Paper
1. Chapter-wise and Topic –wise resentation in Question Banks facilitates systematic study. 2. Question Banks can be referred to by the students throughout the year as well as at the completion of each chapter in school. 3. Question Banks, take into account any changes in syllabus or layout and hence are fully updated and aligned as per the latest specifications by the Board.	1. Year Wise presentation restricts methodical flow of learning. 2. These can be referred to only after the completion of the full syllabus in school. 3. Previous Years' questions cannot be changed and hence fail to be adept with the latest Board specifications

LATEST SYLLABUS

UNIT I : RELATIONS AND FUNCTIONS

1. Relations and Functions

Types of relations : Reflexive, symmetric, transitive, empty, universal and equivalence relations. Examples and problems.

Types of functions : One to one and onto functions, inverse of a function, composite functions, mentioning their properties only, examples and problems.

Binary operations : Associative, commutative, identity, inverse with examples.

2. Inverse Trigonometric Functions

Definition, range, domain, principal value branches. Mentioning domain and range of trigonometric and inverse trigonometric functions. Graphs of inverse trigonometric functions.

Properties and proofs of inverse trigonometric functions given in NCERT prescribed textbook, mentioning formulae for $\sin^{-1}x \pm \sin^{-1}y$, $\cos^{-1}x \pm \cos^{-1}y$,

$2\tan^{-1}x = \tan^{-1}\left(\frac{2x}{1-x^2}\right) = \sin^{-1}\left(\frac{2x}{1+x^2}\right) = \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ without proof.

Conversion of one inverse trigonometric function to another w.r.t to right angled triangle. Problems.

UNIT II : ALGEBRA

1. Matrices

Concept, notation, order,

Types of matrices : Column matrix, row matrix, rectangular matrix, square matrix, zero matrix, diagonal matrix, scalar matrix and unit matrix.

Algebra of matrices : Equality of matrices, addition, multiplication, scalar multiplication of matrices, transpose of a matrix. Mentioning properties with respect to addition, multiplication, scalar multiplication and transpose of matrices.

Symmetric and skew symmetric matrices : Definitions,

properties of symmetric and skew symmetric matrices : proofs of

i) If A is any square matrix, A+A' is symmetric and A-A' is skew symmetric.

ii) Any square matrix can be expressed as the sum of a symmetric and a skew symmetric matrix.

Concept of elementary row and column operations and finding inverse of a matrix restricted to 2 x 2 matrices only.

Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

2. Determinants

Determinant of a square matrix (up to 3 × 3 matrices) : Definition, expansion, properties of determinants, minors , cofactors and problems.

Applications of determinants in finding the area of a triangle.

Adjoint and inverse of a square matrix, definition of singular and non-singular matrices, mentioning their properties :

a) If A and B are non-singular matrices of same order, then AB and BA are non-singular matrices of same order.

b) A square matrix A is invertible if and only if A is non-singular matrix.

Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two and three variables (having unique solution) using inverse of a matrix.

UNIT III : CALCULUS

1. Continuity and Differentiability

Continuity : Definition, continuity of a function at a point and on a domain. Examples and problems, algebra of continuous functions, problems, continuity of composite function and problems.

Differentiability : Definition, Theorem connecting differentiability and continuity with a counter example.

Defining logarithm and mentioning its properties, concepts of exponential, logarithmic functions, Derivative of e^x, $\log x$ from first principles.

Derivative of composite functions using chain rule, problems.

Derivatives of inverse trigonometric functions, problems.

Derivative of implicit function and problems.

Logarithmic differentiation and problems.

Derivative of functions expressed in parametric forms and problems.

Second order derivatives and problems.

Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations and problems.

2. Applications of Derivatives

Tangents and normal : Equations of tangent and normal to the curves at a point and problems.

Derivative as a Rate of change : Derivative as a rate measure and problems.

Increasing/decreasing functions and problems.

Maxima and minima : introduction of extrema and extreme values, maxima and minima in a closed interval, first derivative test, second derivative test.

Simple problems restricted to 2 dimensional figures only.

Approximation and problems.

3. Integrals

Integration as inverse process of differentiation : List of all the results immediately follows from knowledge of differentiation. Geometrical interpretation of indefinite integral, mentioning elementary properties and problems.

Methods of Integration : Integration by substitution, examples. Integration using trigonometric identities, examples.

Integration by partial fractions : Problems related to reducible factors in denominators only.

Integrals of some particular functions :

Evaluation of integrals of $\int \frac{dx}{a^2 \pm x^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}$ and problems.

Problems on integrals of functions like $\int \frac{px+q}{ax^2+bx+c}dx, \int \frac{px+q}{\sqrt{ax^2+bx+c}}dx$.

Integration by parts : Problems , Integrals of type $\int e^x [f(x)+f'(x)]dx$ and related simple problems.

Evaluation of integrals of some more types like $\sqrt{x^2 \pm a^2}, \sqrt{a^2 \pm x^2}$ and problems.

Definite integrals : Definition, Definite integral as a limit of a sum to evaluate integrals of the form $\int_0^a f(x)dx$ only.

Fundamental Theorem of Calculus (without proof).

Basic properties of definite integrals and evaluation of definite integrals.

4. Applications of the integrals :

Area under the curve : Area under simple curves, especially lines, arcs of circles / parabolas / ellipses (in standard form only), Area bounded by two above said curves: problems.

5. Differential Equations

Definition-differential equation, order and degree, general and particular solutions of a differential equation.

Formation of differential equation whose general solution containing at most two arbitrary constants is given.

Solution of differential equations by method of separation of variables, Homogeneous differential equations of first order and first degree.

Solutions of linear differential equation of the type

$\frac{dy}{dx} + py = q$, where p and q are functions of x or constant.

$\frac{dx}{dy} + px = q$, where p and q are functions of y or constant (equation reducible to variable separable, homogeneous and linear differential equation need not be considered).

UNIT IV : VECTORS AND THREE-DIMENSIONAL GEOMETRY

1. Vectors

Definition of vectors and scalars, magnitude and direction of a vector.

Direction cosines/ratios of vectors : Direction angles, direction cosines, direction ratios, relation between direction ratio and direction cosines. Problems.

Types of vectors : Equal, unit, zero, parallel and collinear vectors, coplanar vector, position vector of a point, negative of a vector.

Components of a vector

Algebra of vectors : Multiplication of a vector by a scalar, addition of vectors : triangle law, parallelogram law, properties of addition of vectors, position vector of a point dividing a line segment in a given ratio(section formula).

Scalar (dot) product of vectors : Definition, properties, problems, projection of a vector on a line.

Vector (cross) product of vectors : Definition, properties and problems.

Scalar triple product : Definition, properties and problems.

2. **Three-dimensional Geometry :**

Direction cosines / ratios of a line joining two points.

Straight lines in space : Cartesian and vector equation of a line passing through given point and parallel to given vector, Cartesian and vector equation of a line passing through two given points, coplanar and skew lines, distance between two skew lines(Cartesian and vector approach), distance between two parallel lines (vector approach), angle between two lines, problems related to above concepts.

Plane: Cartesian and vector equation of a plane in normal form, equation of a plane passing through the given point and perpendicular to given vector, equation of a plane passing through three non- collinear points, Intercept form of equation of a plane, angle between two planes, equation of plane passing through the intersection of two given planes, angle between line and plane, condition for the coplanarity of two lines, distance of a point from a plane (vector approach), problems related to above concepts.

Unit V : LINEAR PROGRAMMING

Introduction of L.P.P. definition of constraints, objective function, optimization, constraint equations, non- negativity restrictions, feasible and infeasible region, feasible solutions, Mathematical formulation- mathematical formulation of L.P.P.

Different types of L.P.P : Problems namely manufacturing, diet and allocation problems with bounded feasible regions only, graphical solutions for problem in two variables, optimum feasible solution(up to three non-trivial constraints).

Unit VI : PROBABILITY

Conditional probability : Definition, properties, problems.

Multiplication theorem, independent events, Baye's theorem, theorem of total probability and problems.

Probability distribution of a random variable-definition of a random variable, probability distribution of random variable, mean , variance of a random variable and problems.

Bernoulli trials and Binomial distribution :

Definition of Bernoulli trial, binomial distribution, conditions for Binomial distribution, and simple problems.

Note : **Unsolved miscellaneous problems given in the prescribed text book need not be considered.**

DESIGN OF THE QUESTION PAPER

MATHEMATICS (35) CLASS : II PUC

Time: 3 hours 15 minutes; Max. Mark:100

(*of which 15 minutes for reading the question paper*).

The weightage of the distribution of marks over different dimensions of the question paper shall be as follows:

I. Weightage to Objectives :

Objective	Weightage	Marks
Knowledge	40%	60/150
Understanding	30%	45/150
Application	20%	30/150
Skill	10%	15/150

II. Weightage to level of difficulty :

Level	Weightage	Marks
Easy	35%	53/150
Average	55%	82/150
Difficult	10%	15/150

III. Weightage to content :

Chapter No.	Chapter	No. of Teaching Hours	Marks
1	RELATIONS AND FUNCTIONS	11	11
2	INVERSE TRIGONOMETRIC FUNCTIONS	8	8
3	MATRICES	8	14
4	DETERMINANTS	13	7
5	CONTINUITY AND DIFFERENTIABILITY	19	15
6	APPLICATION OF DERIVATIVES	11	10
7	INTEGRALS	21	22
8	APPLICATION OF INTEGRALS	8	8
9	DIFFERENTIAL EQUATIONS	9	12
10	VECTOR ALGEBRA	11	11
11	THREE DIMENSIONAL GEOMETRY	12	11
12	LINEAR PROGRAMMING	7	7
13	PROBABILITY	12	11
	Total	**150**	**147**

IV. Pattern of the question paper :

PART	Type of questions	Number of questions to be set	Number of questions to be answered	Remarks
A	1 mark questions	10	10	Compulsory part
B	2 marks questions	14	10	—
C	3 marks questions	13	10	—
D	5 marks questions	10	6	Questions must be asked from the specific set of topics as mentioned below, under section V
E	10 marks questions (Each question with two subdivisions namely a) 6 marks and b) 4 marks.	2	1	

V. Instructions :

Content areas to select questions for PART – D and PART – E

a) In PART D :

1. **Relations and functions:** Problems on verification of invertibility of a function and writing its inverse.

For example :

a. Show that the function, $f: R \to R$ defined by $f(x) = 4x + 3$ is invertible. Hence write the inverse of f.

b. Let R_+ be the set of all non-negative real numbers. Show that the function $f : R_+ \to [4, \infty)$ defined by $f(x) = x^2 + 4$ is invertible. Also write the inverse of $f(x)$.

c. If R_+ is the set of all non-negative real numbers prove that the function $f : R_+ \to [-5, \infty)$ defined by $f(x) = 9x^2 + 6x - 5$ is invertible. Write also $f^{-1}(x)$.

2. **Matrices:** Problems on verifications of basic conclusions on algebra of matrices.

For example :

a. If $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 3 \\ -1 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & -2 \\ 3 & 0 \end{bmatrix}$, verify that $A(BC) = (AB)C$.

b. If $A = \begin{bmatrix} 1 & 5 \\ 2 & 0 \\ -3 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 3 & -1 & 2 \\ 4 & 2 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & 1 & 2 \\ 0 & 3 & 2 \end{bmatrix}$, find A + B and B – C. Show that

$A + (B - C) = (A + B) - C$.

c. If $A = \begin{bmatrix} -1 & 2 \\ 2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 1 & -3 \\ -3 & 4 \end{bmatrix}$, verify that AB – BA is a skew symmetric matrix and AB + BA is a symmetric matrix.

3. **Determinants :** Problems on finding solution to simultaneous linear equations involving three unknown quantities by matrix method.

   For example :

   a. Solve the following by using matrix method:

   $\frac{2}{x}+\frac{3}{y}+\frac{10}{z}=4$, $\frac{4}{x}-\frac{6}{y}+\frac{5}{z}=4$, $\frac{6}{x}+\frac{9}{y}-\frac{20}{z}=4$.

   b. Solve the following by using matrix method:

   $2x+y+z=1, x-2y-z=\frac{3}{2}, 3y-5z=9$.

   c. Use the product $\begin{pmatrix}1 & -1 & 2\\ 0 & 2 & -3\\ 3 & -2 & 4\end{pmatrix}\begin{pmatrix}-2 & 0 & 1\\ 9 & 2 & -3\\ 6 & 1 & -2\end{pmatrix}$ to solve the system of equations $x-y+2z=1, 2y-3z=1,$

   $3x-2y+4z=9.$

4. **Continuity and differentiability :** Problems on second derivatives.

   For example :

   a. If $x=a(\cos t+t.\sin t)$ and $y=a(\sin t-t.\cos t)$ find $\frac{d^2y}{dx^2}$.

   b. If $(x-a)^2+(y-b)^2=c^2, c>0$, prove that $\frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\frac{d^2y}{dx^2}}$ is a constant independent of a and b.

   c. If $e^y(x+1)=1$ prove that $\frac{dy}{dx}=-e^y$. Hence prove that $\frac{d^2y}{dx^2}=\left(\frac{dy}{dx}\right)^2$.

5. **Application of derivatives :** Problems on derivative as a rate measurer.

   For example :

   a. A ladder 5m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall at the rate of 2 cm / sec. How fast is its height of the wall decreasing when the foot of the ladder is 4m away from the wall?

   b. Sand is pouring from a pipe at the rate of 12 cm^3 / sec . The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand cone increasing when the height is 4 cm?

   c. A stone is dropped into a quit lake and waves move in circles at a speed of *4 cm/sec.* At the instant, when the radius of the circular wave is 10 cm, how fast is the enclosed area increasing?

6. **Integrals :** Derivations on indefinite integrals and evaluation of an indefinite integral by using the derived formula.

   For example :

   a. Find the integral of $\frac{1}{\sqrt{x^2-a^2}}$ with respect to x and hence evaluate $\int\frac{1}{\sqrt{x^2-25}}\,dx$.

b. Find the integral of $\sqrt{a^2 - x^2}$ with respect to x and hence evaluate $\int \sqrt{1 + 4x - x^2}\ dx$.

c. Find the integral of $\frac{1}{x^2 - a^2}$ with respect to x and hence evaluate $\int \frac{x}{x^4 - 16}\ dx$.

7. **Application of integrals :** Problems on finding the area of the bounded region by the method of integration.

   For example :

   a. Find the area of the region enclosed between the two circles and $x^2 + y^2 = 4$ and $(x-2)^2 + y^2 = 4$

   b. Find the area bounded by the curve $x^2 = 4y$ and the line $x = 4y - 2$.

   c. Find the area of the region in the first quadrant enclosed by the x axis, the line $y = x$ and the circle, $x^2 + y^2 = 32$.

8. **Differential equations :** Problems on solving linear differential equations.

   For example :

   a. Solve the differential equation, $x \frac{dy}{dx} + 2y = x^2 \log x$.

   b. Find a particular solution of the differential equation $\frac{dy}{dx} - 3y.\cot x = \sin 2x$, $y = 2$, when $x = \frac{\pi}{2}$.

   c. Find the equation a curve passing through the point (0, 1).If the slope of the tangent to the curve at any point (x, y) is equal to the sum of x coordinate and the product of x coordinate and y coordinate of that point.

9. **Three dimensional geometry :** Derivations on 3 dimensional geometry (both vector and Cartesian form).

   For example :

   a. Derive a formula to find the shortest distance between the two skew lines $\vec{r} = \vec{a}_1 + l\vec{b}_1$ and $\vec{r} = \vec{a}_2 + \mu\vec{b}_2$ in the vector form.

   b. Derive the equation of a plane passing through three non collinear points both in the vector and Cartesian form.

   c. Derive the equation of a line in space passing through two given points both in the vector and Cartesian form.

10. **Probability :** Problems on Bernoulli trials and binomial distribution.

    For example :

    a. A die is thrown 6 times. If "getting an odd number" is a success, what is the probability of (i) 5 successes (ii) at least 5 successes?

    b. Five cards are drawn successively with replacement from a well shuffled deck of 52 playing cards. What is the probability that (i) all the five cards are spades? (ii) only 3 cards are spades? (iii) none is a spade?

    c. The probability that a bulb produced by a factory will fuse after 150 days of use is 0.05. Find the probability that out of 5 such bulbs (i) none will fuse after 150 days. (ii) at most two will fuse after 150 days.

b) In PART E :

(i) 6 marks questions must be taken from the following content areas only.

1. **Integrals :** Derivations on definite integrals and evaluation of a definite integral using the derived formula.

   For example :

   a. Prove that $\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$ and hence evaluate $\int_0^{\pi/2} \log(\sin x)\,dx$.

   b. Prove that $\int_a^b f(x)\,dx = \int_a^c f(x)\,dx + \int_c^b f(x)\,dx$ and hence evaluate $\int_{-1}^{2} |x^3 - x|\,dx$.

   c. Prove that $\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x), & \text{if } f(2a-x) = f(x) \\ 0, & \text{if } f(2a-x) = -f(x) \end{cases}$ and hence evaluate $\int_0^{\pi} \frac{1}{a^2\cos^2 x + b^2 \sin^2 x}\,dx$.

2. **Linear programming** : Problems on linear programming.

   For example :

   a. A corporative society of farmers has 50 hectare of land to grow two crops X and Y. The profit from crops X and Y per hectare are estimated as Rs 10,500 and Rs 9,000 respectively. To control weeds, a liquid herbicide has to be used for crops X and Y at rates of 20 litres and 10 litres per hectare. Further no more than 800 litres of herbicide should be used in order to protect fish and wild life using a pond which collects drainage from this land. How much should be allocated to each crop so as to maximize the total profit of the society?

   b. Solve the following linear programming problem graphically: Minimize and maximize $z=x+2y$, subject to constraints, $x+2y \geq 100, 2x-y \leq 0, 2x+y \leq 200, x, y \geq 0$

   c. There are two types of fertilizers F_1 and F_2. F_1 consists of 10% nitrogen and 6% phosphoric acid and F_2 consists of 5% nitrogen and 10% phosphoric acid. After testing the soil conditions, a farmer finds that he needs at least 14 kg of nitrogen and 14 kg of phosphoric acid for his crop. If F_1 costs Rs 6/kg and F_2 costs Rs 5/kg, determine how much of each type of fertilizer should be used so that nutrient requirements are met at a minimum cost. What is the minimum cost?

(ii) 4 marks questions must be taken from the following content areas only.

1. **Continuity and differentiability** : Problems on continuous functions.

   For example :

   a. Verify whether the function $f(x) = \begin{cases} x, & \text{if } x \geq 0 \\ x^2, & \text{if } x < 0 \end{cases}$ is continuous function or not.

   b. Find the points of discontinuity of the function $f(x) = x - [x]$, where $[x]$ indicates the greatest integer not greater than x. Also write the set of values of x, where the function is continuous.

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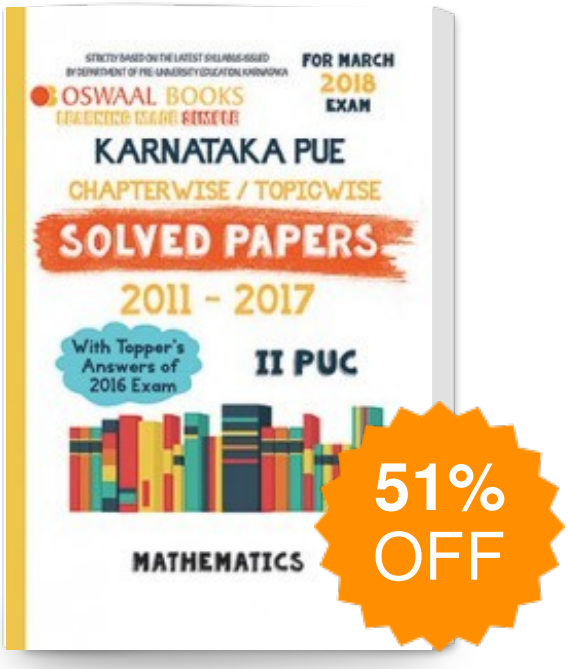

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