Rayat Shikshan Sansth's

Shri Sadguru Gangageer Maharaj Science, Gautam Arts and Sanjivani Commerce College, Kopargaon 423601, Dist. Ahmednagar, (MS)-India

Internal Quality Assurance Cell
(IQAC)
Syllabus Approval Letter

Date – 21/12/2019

The IQAC committee has approved to submitted syllabus of short term/COC courses planted to be conducted by Department Mathematics.

Sr. No.	Name of the Courses	Type of Course
1	Mathematics for Competitive Examinations	Short Term Course

HOD of Mathematics may proceed accordingly.

Date :-21/12/2019

Place: Kopargaon

for 'Head'
Department of Mathematics,
S. S. G. M. College, Kopargaon.

IQAC- Coordinator

S.S.G.M. College, Kopargaon

Introduction:

Mathematics department has decided to start a short-term course "Mathematics for Competitive Exam". Taking into consideration a new approaches in different areas of Mathematics. Mathematics department has prepared the syllabus for stated course.

The committee was constituted as follows

1. Prin. Dr. S.R. Thopate

2. Ms. D. R. Chouhan (Head and member)

3. Mr.R. J. Ukirde (Member)

4. Dr. P. G. Andhare (Ex-Member of BOS, SPPU, Pune)

Aims:

1. Develop mathematical curiosity and inductive and deductive reasoning when solving problems.
2. Develop the knowledge, skills, and attitudes necessary to pursue further study in mathematics.
3. Develop abstract, logical and critical thinking.

Objectives:

1. Use appropriate mathematical concepts and skills to solve problems.
2. Know and demonstrate understanding of the mathematical concepts.
3. Select and apply general rules correctly to solve problems.

Details of Syllabus:

Real Analysis – (08 Lect.)

Sequence and series of real numbers, Limit, Continuity, Differentiation, Mean Value Theorems, Partial Derivatives and Euler's theorem, Convergence and divergence, Cauchy sequences, Tests of convergence, Alternate series and their convergence

Linear Algebra – (08 Lect.)

Matrix Algebra and System of Linear equations, Vector spaces, Linear Dependence, Basis, Dimension, Linear Transforms, Rank-Nullity theorem, Eigen values and Eigen vectors, Cayley-Hamilton theorem, Diagonalization of matrices, Hermition and skew hermition matrices.

Abstract Algebra – (06 Lect.)

Group, Subgroup, Cyclic group, Normal subgroup, Lagrange's theorem, Permutation group, Quotient group, Homomorphism's and Isomorphism

Metric Spaces – (06 Lect.)

Metric spaces, Open and Closed sets, Interior points, Closure of a set, Convergent sequence, Cauchy sequences, Complete spaces, Dense set, compactness, Connectedness

Basics of Set Theory- (06 Lect.)

Cantor's concept of a set, Intuitive set theory, Inclusion, Operations for sets, Algebra of sets, Ordering relations, Power sets, Numerical Equivalence of sets. Natural Number sequence, Induction and Recursion, Cardinal numbers and Cardinality, Cardinal arithmetic, Countable and Uncountable sets, Paradoxes set theory, Russell's Paradox.

Expected Number of Students = 15

Course Duration: 2 Months.Jan.20, Feb.20

Fees : Nil

for Head,

Department of Mathematics,

Principal,

S.S.G.M. College, Kopargaon

Rayat Shikshan Sanstha's,

S.S.G.M. College, Kopargaon
Department of Mathematics
SHORT-TERM COURSE (2019-20)
<u>Notice</u>

Date:09/12/2019

All the students of T.Y.B.Sc .Mathematics are hereby informed that, Mathematics Department is going to start a Short Term Course --"Mathematics for Competitive Examinations". Duration of the course is two months (Jan.2020,Feb.2020). Syllabus of the course is displayed on the notice board. The course will start on Monday 1st Jan 2020.

Interested students should give their names to Prof. D. R. Chouhan on or before 20/12/2019.

for Head,

Department of Mathematics,

Principal,

S.S.G.M. College, Kopargaon

Rayat Shikshan Sanstha's
Shri Sadguru Gangageer Maharaj Science, Gautam Arts and Sanjivani Commerce College, Kopargaon, Dist.-Ahmednagar

DEPARTMENT OF MATHEMATICS

Mathematics For Competitive Examination
YEAR 2019-2020

Sr. No.	Name of the Teacher	Topics Taught
1	Mrs. D.R.Chouhan	**Chapter-III Abstract Algebra** (06 Lectures) Group, Subgroup, Cyclic group, Normal subgroup, Lagrange's theorem, Permutation group, Quotient group, Homomorphism's and Isomorphism
2	Mr. R.J.Ukirde	**Chapter-IV Metric Spaces** (06 Lectures) Metric spaces, Open and Closed sets, Interior points, Closure of a set, Convergent sequence, Cauchy sequences, Complete spaces, Dense set, compactness, Connectedness
3	Mr.T.N.Hon	**Chapter-I Real Analysis** (06 Lectures) Sequence and series of real numbers, Limit, Continuity, Differentiation, Mean Value Theorems, Partial Derivatives and Euler's theorem, Convergence and divergence, Cauchy sequences, Tests of convergence, Alternate series and their convergence
4	Miss.B.R.Tambe	**Chapter-II Linear Algebra** (06 Lectures) Matrix Algebra and System of Linear equations, Vector spaces, Linear Dependence, Basis, Dimension, Linear Transforms, Rank-Nullity theorem, Eigen values and Eigen vectors, Cayley-Hamilton theorem, Diagonalization of matrices,Hermition and skew hermition matrices.
5	Mr.H.T.Hon and Mr. R.J.Ukirde	**Chapter-V Basics of Set Theory** (06 Lectures) Cantor's concept of a set, Intuitive set theory, Inclusion, Operations for sets, Algebra of sets, Ordering relations, Power sets, Numerical Equivalence of sets. Natural Number sequence, Induction and Recursion, Cardinal numbers and Cardinality, Cardinal arithmetic, Countable and Uncountable sets, Paradoxes set theory, Russell's Paradox

Head
Dept. of Mathematics

Chairman
Short Term Course Committee

Principal
S.S.G.M.Science, Gautam Arts and
Sanjivani Commerce College, Kopargaon

DEPARTMENT OF MATHEMATICS

List of Students For Short-Term Course

"Mathematics For Competitive Examinations"

(2019-2020)

Sr.No.	Name of Student	Class
1.	DAREKAR PRIYA RAVINDRA	T.Y.B.Sc.
2.	DESHMUKH PRATIKSHA PRAKASH	T.Y.B.Sc.
3.	DHADIWAL TEJAL SANTOSH	T.Y.B.Sc.
4.	DIVEKAR SHRADDHA RAMESH	T.Y.B.Sc.
5.	GAIKWAD ASHUTOSH DNYANDEV	T.Y.B.Sc.
6.	JADHAV MANSI ARUN	T.Y.B.Sc.
7.	KACHHI NILOFAR RAJU	T.Y.B.Sc.
8.	KADAM ANUJA BHASKAR	T.Y.B.Sc.
9.	KALE SHRADDHA GITARAM	T.Y.B.Sc.
10.	MALI POOJA GORAKH	T.Y.B.Sc.

Duration of the course : 2 Months -01st Jan.2020 to 28th Feb.2020

Fees : Nil

for Head.
Department of Mathematics,
S. S. G. M. College, Kopargaon

Principal
S.S.G.M.Science,Gautam Arts &
Sanjivani Commerce College,Kopargaon

Rayat Shikshan Sanstha's

S.S.G.M.College, Kopargaon.

Mathematics Department

Short-Term Course

"Mathematics For Competitive Examinations"

Time- Table (2019-20)

Duration: 02 Months (Jan.20, Feb.20)

w.e.f. 01/01/2020

Time	Monday	Tuesday	Wednesday
03.45-04.45	Ms. D. R. Chouhan (A-101)	Mr. R. J. Ukirde (A-101)	Mr.T.N. Hon (A-101)

for Head,

Department of Mathematics,

Principal,

S.S.G.M. College, Kopargaon

List of Students For Short-Term Course

"Mathematics For Competitive Examinations"

(2019-2020)

<u>Attendance</u>

Month: Jan. 2020

Sr.No.	Name of Student	06/01	07/01	08/01	13/01	14/01	20/01	21/01	22/01	27/01	28/01	29/01	
1.	DAREKAR PRIYA RAVINDRA	P	P	P	A	P	P	P	P	P	P	P	
2.	DESHMUKH PRATIKSHA PRAKASH	P	A	P	P	P	A	P	P	P	A	P	
3.	DHADIWAL TEJAL SANTOSH	P	P	P	P	P	P	P	P	P	P	P	
4.	DIVEKAR SHRADDHA RAMESH	P	P	P	P	A	P	P	P	P	P	P	
5.	GAIKWAD ASHUTOSH DNYANDEV	A	P	P	P	P	P	P	A	P	P	P	
6.	JADHAV MANSI ARUN	P	P	P	P	P	P	P	P	P	P	P	
7.	KACHHI NILOFAR RAJU	P	P	A	P	P	A	P	P	A	P	P	
8.	KADAM ANUJA BHASKAR	P	P	P	P	P	P	P	P	P	P	P	
9.	KALE SHRADDHA GITARAM	P	P	P	A	P	P	A	P	P	P	P	
10.	MALI POOJA GORAKH	A	P	P	P	P	P	P	P	P	P	A	

for Head,
Department of Mathematics,
S S G M College, Kopargaon

List of Students For Short-Term Course

"Mathematics For Competitive Examinations"

(2019-2020)

<u>Attendance</u>

Month: Feb. 2020

Sr.No.	Name of Student	03/02	04/02	05/02	10/02	11/02	12/02	17/02	18/02	24/02	25/02		
1.	DAREKAR PRIYA RAVINDRA	P	P	A	P	P	A	P	P	P			
2.	DESHMUKH PRATIKSHA PRAKASH	A	P	P	P	P	P	P	A	P	P		
3.	DHADIWAL TEJAL SANTOSH	P	P	P	P	P	P	P	P	P			
4.	DIVEKAR SHRADDHA RAMESH	P	A	P	A	P	P	P	A	P	P		
5.	GAIKWAD ASHUTOSH DNYANDEV	P	P	P	P	P	A	P	P	P	A		
6.	JADHAV MANSI ARUN	P	P	A	P	P	P	P	A	P	P		
7.	KACHHI NILOFAR RAJU	P	P	P	P	P	P	A	P	P	P		
8.	KADAM ANUJA BHASKAR	P	P	A	P	P	P	P	P	P	P		
9.	KALE SHRADDHA GITARAM	P	P	P	P	P	A	P	A	P			
10.	MALI POOJA GORAKH	P	P	A	P	P	P	P	P	P			

for **Head**,
Department of Mathematics,
S. S G M College, Kopargaon

Note: 1) Attempt *all* the questions. *Each* question carries *2 marks.*

1.

Define $f_1, f_2 : [0,1] \to \mathbb{R}$ by
$$f_1(x) = \sum_{n=1}^{\infty} \frac{x \, \sin(n^2 x)}{n^2} \quad \text{and} \quad f_2(x) = \sum_{n=1}^{\infty} x^2 (1 - x^2)^{n-1}.$$

Then

(A) f_1 is continuous but f_2 is NOT continuous
(B) f_2 is continuous but f_1 is NOT continuous
(C) both f_1 and f_2 are continuous
(D) neither f_1 nor f_2 is continuous

2.

The system of linear equations
$$
\begin{aligned}
x - y + 2z &= b_1 \\
x + 2y - z &= b_2 \\
2y - 2z &= b_3
\end{aligned}
$$

is inconsistent when (b_1, b_2, b_3) equals

(A)   (2, 2, 0)   (B)   (0, 3, 2)   (C)   (2, 2, 1)   (D)   (2, −1, −2)

3.

Let $x_n = 2^{2n} \left(1 - \cos\left(\frac{1}{2^n}\right) \right)$ for all $n \in \mathbb{N}$. Then the sequence $\{x_n\}$

(A)   does NOT converge   (B)   converges to 0

(C)   converges to $\dfrac{1}{2}$ (D)   converges to $\dfrac{1}{4}$

4.

The set $\left\{ \dfrac{x^2}{1+x^2} : x \in \mathbb{R} \right\}$ is

(A)   connected but NOT compact in $\mathbb{R}$ (B)   compact but NOT connected in $\mathbb{R}$
(C)   compact and connected in $\mathbb{R}$ (D)   neither compact nor connected in $\mathbb{R}$

5.

Let $\sum_{n=1}^{\infty} a_n$ and $\sum_{n=1}^{\infty} b_n$ be two series, where $a_n = \dfrac{(-1)^n n}{2^n}$, $b_n = \dfrac{(-1)^n}{\log(n+1)}$ for all $n \in \mathbb{N}$. Then

(A) both $\sum_{n=1}^{\infty} a_n$ and $\sum_{n=1}^{\infty} b_n$ are absolutely convergent

(B) $\sum_{n=1}^{\infty} a_n$ is absolutely convergent but $\sum_{n=1}^{\infty} b_n$ is conditionally convergent

(C) $\sum_{n=1}^{\infty} a_n$ is conditionally convergent but $\sum_{n=1}^{\infty} b_n$ is absolutely convergent

(D) both $\sum_{n=1}^{\infty} a_n$ and $\sum_{n=1}^{\infty} b_n$ are conditionally convergent

6.

For all $(x, y) \in \mathbb{R}^2$, let $f(x, y) = \begin{cases} x & \text{if } y = 0, \\ x - y^3 \sin(1/y) & \text{if } y \neq 0. \end{cases}$

Then at the point $(0, 0)$,

(A) f is NOT continuous

(B) f is continuous but NOT differentiable

(C) $\dfrac{\partial f}{\partial x}$ exists but $\dfrac{\partial f}{\partial y}$ does NOT exist

(D) f is differentiable

7.

The value of $\int_{x=0}^{1} \int_{y=0}^{x^2} \int_{z=0}^{y} (y + 2z) \, dz \, dy \, dx$ is

(A) $\dfrac{1}{53}$

(B) $\dfrac{2}{21}$

(C) $\dfrac{1}{6}$

(D) $\dfrac{5}{3}$

8.

Let G be a cyclic group of order 24. The total number of group isomorphisms of G onto itself is

(A) 7

(B) 8

(C) 17

(D) 24

9.

Which of the following groups contains a unique normal subgroup of order four?

(A) $\mathbb{Z}_2 \oplus \mathbb{Z}_4$

(B) The dihedral group, D_4, of order eight

(C) The quaternion group, Q_8

(D) $\mathbb{Z}_2 \oplus \mathbb{Z}_2 \oplus \mathbb{Z}_2$

10.

Let S be the oriented surface $x^2 + y^2 + z^2 = 1$ with the unit normal $\mathbf{n}$ pointing outward. For the vector field $\mathbf{F}(x, y, z) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$, the value of $\iint\limits_S \mathbf{F} \cdot \mathbf{n} \, dS$ is

(A) $\dfrac{\pi}{3}$ (B) 2π (C) $\dfrac{4\pi}{3}$ (D) 4π

11.

The value of $\iint\limits_R xy \, dx \, dy$, where R is the region in the first quadrant bounded by the curves $y = x^2$, $y + x = 2$ and $x = 0$ is _____

12.

The radius of convergence of the power series $\displaystyle\sum_{n=0}^{\infty} 4^{(-1)^n n} z^{2n}$ is _____

13.

Let

$$f(x, y) = \begin{cases} \dfrac{2(x^3 + y^3)}{x^2 + 2y}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0). \end{cases}$$

Show that the first order partial derivatives of f with respect to x and y exist at $(0,0)$. Also show that f is not continuous at $(0,0)$.

14.

Evaluate

$$\int\limits_{1/4}^{1} \int\limits_{\sqrt{x-x^2}}^{\sqrt{x}} \frac{x^2 - y^2}{x^2} \, dy \, dx$$

by changing the order of integration.

15.

Let $\vec{F} = 2z\hat{i} + 4x\hat{j} + 5y\hat{k}$, and let C be the curve of intersection of the plane $z = x + 4$ and the cylinder $x^2 + y^2 = 4$, oriented counter-clockwise. The value of $\oint\limits_C \vec{F} \cdot d\vec{r}$ is

16.

The set of points at which the function $f(x, y) = x^4 + y^4 - x^2 - y^2 + 1$, $(x, y) \in \mathbb{R}^2$ attains local maximum is

17.

Let $u = \dfrac{y^2 - x^2}{x^2 y^2}$, $v = \dfrac{z^2 - y^2}{y^2 z^2}$ for $x \neq 0$, $y \neq 0$, $z \neq 0$. Let $w = f(u, v)$, where f is a real valued function defined on $\mathbb{R}^2$ having continuous first order partial derivatives. The value of $x^3 \dfrac{\partial w}{\partial x} + y^3 \dfrac{\partial w}{\partial y} + z^3 \dfrac{\partial w}{\partial z}$ at the point $(1, 2, 3)$ is

18.

The orthogonal trajectory of the family of curves $\dfrac{x^2}{2} + y^2 = c$, which passes through $(1, 1)$ is

19.

The function to which the power series $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} n\, x^{2n-2}$ converges is

20.

The value of $\dfrac{i}{4-\pi} \displaystyle\int_{|z|=4} \dfrac{dz}{z \cos(z)}$ is equal to _____

21.

Find all the critical points of the function $f : \mathbb{R}^2 \to \mathbb{R}$ defined by $f(x, y) = x^3 + xy + y^3$ for all $(x, y) \in \mathbb{R}^2$. Also, examine whether the function f attains a local maximum or a local minimum at each of these critical points.

22.

Consider the following linear programming problem:

$$\begin{array}{ll} \text{Maximize} & x + 3y + 6z - w \\ \text{subject to} & 5x + y + 6z + 7w \le 20, \\ & 6x + 2y + 2z + 9w \le 40, \\ & x \ge 0,\ y \ge 0,\ z \ge 0,\ w \ge 0. \end{array}$$

Then the optimal value is _____

23.

Let M be the real vector space of 2×3 matrices with real entries. Let $T : M \to M$ be defined by

$$T\left(\begin{bmatrix} x_1 & x_2 & x_3 \\ x_4 & x_5 & x_6 \end{bmatrix}\right) = \begin{bmatrix} -x_6 & x_4 & x_1 \\ x_3 & x_5 & x_2 \end{bmatrix}.$$

The determinant of T is _____

24.

Let $D = \{(x, y) \in \mathbb{R}^2 : 1 \le x \le 1000,\ 1 \le y \le 1000\}$. Define

$$f(x, y) = \dfrac{x\,y}{2} + \dfrac{500}{x} + \dfrac{500}{y}.$$

Then the minimum value of f on D is equal to _____

25.

Let M be the space of all 4×3 matrices with entries in the finite field of three elements. Then the number of matrices of rank three in M is

(A) $(3^4 - 3)(3^4 - 3^2)(3^4 - 3^3)$
(B) $(3^4 - 1)(3^4 - 2)(3^4 - 3)$
(C) $(3^4 - 1)(3^4 - 3)(3^4 - 3^2)$
(D) $3^4(3^4 - 1)(3^4 - 2)$

Result of Examination conducted For Short-Term Course

"Mathematics For Competitive Examinations"

(2019-2020)

Sr.No.	Name of Student	Class	Marks
1.	DAREKAR PRIYA RAVINDRA	T.Y.B.Sc.	44
2.	DESHMUKH PRATIKSHA PRAKASH	T.Y.B.Sc.	46
3.	DHADIWAL TEJAL SANTOSH	T.Y.B.Sc.	50
4.	DIVEKAR SHRADDHA RAMESH	T.Y.B.Sc.	38
5.	GAIKWAD ASHUTOSH DNYANDEV	T.Y.B.Sc.	50
6.	JADHAV MANSI ARUN	T.Y.B.Sc.	32
7.	KACHHI NILOFAR RAJU	T.Y.B.Sc.	38
8.	KADAM ANUJA BHASKAR	T.Y.B.Sc.	28
9.	KALE SHRADDHA GITARAM	T.Y.B.Sc.	48
10.	MALI POOJA GORAKH	T.Y.B.Sc.	50

for Head,

Department of Mathematics,
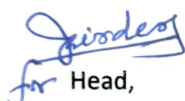
Principal,

S.S.G.M. College, Kopargaon

DEPARTMENT OF MATHEMATICS

Report of Short-Term Course

"Mathematics For Competitive Examinations"

(2019-2020)

The Department of Mathematics has conducted a Short Term Course on "Mathematics For Competitive Examinations". The duration of the course was 2 months (Jan. 2020-Feb. 2020). Lectures were taken by the faculties of the Department. 10 students of T.Y.B.Sc have participated in this course. This course was conducted free for the students. Overall performance of the students was evaluated on the basis of 50 marks exam which was objective type containing 25 questions each carrying 2 marks. 3 students have scored 100 % marks.

Head,

Dept. of Mathematics

Principal,

S. S. G. M. College, Kopargaon

"EDUCATION THROUGH SELF - HELP IS OUR MOTTO" - Karmaveer

Rayat Shikshan Sanstha's

Shri Sadguru Gangageer Maharaj Science, Gautam Arts & Sanjivani Commerce College

Kopargaon, Dist. Ahmednagar (M.S.)

Certificate of Completion

Short Term Course

This is to Certify that Shri/Kum. _____

of Class _____ has Completed Short Term Course in _____

_____ conducted by the department of _____

during the academic year 201   /201

Course Co-ordinator   Co-ordinator   Principal

Department of Mathematics

Short Term Course: Mathematics For Competitive Examination

2019-20

Feedback form

Class: T. Y. B-SC.

Date: 28/02/2020

Name of the student: Jadhav Manasi Arun

About the Course Information on the Respondent: (Tick (√) Appropriate Option)

	Questionaries	Excellent A	Very Good B	Good C	Satisfactory D	Poor E
1.	Quality of the Teaching/lecture		✓			
2.	Were objectives of the course clear to you?		✓			
3.	The course contents compared with your expectations?	✓				
4.	Level of preparation		✓			
5.	Overall evaluation of the course	✓				
6.	Level of Interaction		✓			

Sign of the Student

Shri Sadguru Gangageer Maharaj Science, Gautam Arts and Sanjivani Commerce College, Kopargaon, Dist- Ahmednagar- 423601, (M.S) India

Department of Mathematics

Short Term Course: Mathematics For Competitive Examination
2019-20

Feedback form

Class: **T.Y.BSc.**   Date: **25/02/2020**

Name of the student: **Dhadiwal Tejal Santosh**

About the Course Information on the Respondent: (Tick (√) Appropriate Option)

	Questionaries	Excellent A	Very Good B	Good C	Satisfactory D	Poor E
1.	Quality of the Teaching/lecture	✓				
2.	Were objectives of the course clear to you?			✓		
3.	The course contents compared with your expectations?			✓		
4.	Level of preparation		✓			
5.	Overall evaluation of the course	✓				
6.	Level of Interaction		✓			

Sign of the Student

Rayat Shikshan Santha's

Shri Sadguru Gangageer Maharaj Science, Gautam Arts and Sanjivani Commerce College, Kopargaon, Dist- Ahmednagar- 423601, (M.S) India

Department of Mathematics

Short Term Course: Mathematics For Competitive Examination

2019-20

Feedback form

Class: ~~Mali~~ T.Y.B.Sc.　　　　　　　　　　　　　　Date: 25/02/2020

Name of the student: Mali Pooja Gorakh

About the Course Information on the Respondent: (Tick (√) Appropriate Option)

	Questionaries	Excellent A	Very Good B	Good C	Satisfactory D	Poor E
1.	Quality of the Teaching/lecture	✓				
2.	Were objectives of the course clear to you?		✓			
3.	The course contents compared with your expectations?	✓				
4.	Level of preparation		✓			
5.	Overall evaluation of the course	✓				
6.	Level of Interaction		✓			

Sign of the Student