CHRIST
(DEEMED TO BE UNIVERSITY)
BANGALORE · INDIA

DEPARTMENT - MATHEMATICS

Course Pack
FOR
REAL ANALYSIS-MAT331

MAT331 - REAL ANALYSIS

Total Teaching Hours For Semester : 60 **Total Teaching Hours For Semester : 4**

Max Marks : 100 **Credits : 4**

Course Objectives/Course Description:

This course enables the students to understand the basic techniques and theories of real analysis.

Learning Outcome

On successful completion of the course, the students should be able to

Quote and understand the definition of a limit of a sequence or a function in its various forms
Demonstrate the convergence or divergence of the geometric and harmonic series and other standard series
apply the basic tests for convergence of infinite series
Prove the tests for convergence: Comparison Test, Ratio Test, Cauchy's Root test, Raabe's Test, Alternating Series Test etc.
Understand the differences between convergence and absolute convergence
Understand and solve binomial , logarithmic and exponential series

Unit-1 **Teaching Hours:20**

Sets and Sequences in R

Open sets, Closed sets, closure of a set, countable and uncountable sets, topology of real line.
Sequences: Definition of Sequences, limit of a sequence, algebra of limits of a sequence, convergent, divergent and oscillatory sequences, problems thereon. Bounded sequences, Monotonic sequences and their properties, Cauchy sequence.

Unit-2 **Teaching Hours:20**

Infinite Series

Infinite series, Cauchy convergence criterion for series, geometric series, comparison test, convergence of p-series, D'Alembert's Ratio test, Raabe's test, Cauchy's Root test, alternating series, Leibnitz's test. Definition and examples of absolute and conditional convergence.

Unit-3 **Teaching Hours:20**

Sequence and Series of functions

Sequences and series of functions, Pointwise and uniform convergence. M_n-test, M-test, Statements of the results about uniform convergence. Power series and radius of convergence.

Text Books And Reference Books:

T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.

S.C.Malik and Savita Arora, Mathematical Analysis, Second Edition, New Delhi, India: New Age international (P) Ltd., 2005.

Essential Reading / Recommended Reading:

R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia) P. Ltd., 2000.

E. Fischer, *Intermediate Real Analysis*,1st ed.(Reprint), Springer Verlag, 2012.

K.A. Ross, Elementary *Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics* , Springer Verlag, 2003.

S Narayana and M.D. Raisinghania, Elements of Real Analysis, Revised ed., S. Chand & Company Ltd, 2011.

Additional Information

ESE - FORMAT OF QUESTION PAPER

Part	Unit and No. of subdivisions to be set in the unit		No. of subdivisions to be answered	Marks for each subdivision	Max. marks for the part
A	Unit I	4	8	3	24
	Unit II	4			
	Unit III	4			
B	Unit I	3	7	8	56
	Unit II	3			
	Unit III	3			
C	Unit I	1	2	10	20
	Unit II	1			
	Unit III	1			
Total					100

Evaluation Pattern

Component	Mode of Assessment	Parameters	Points
CIA I	MCQ, Written Assignment. Reference work	Mastery of the core concepts Problem solving skills	**10**
CIA II	Mid-semester Examination	Basic, conceptual and analytical knowledge of the subject	**25**
CIA III	Assignment / Written Assignment	Written Assignment based on Sequences and Series	**10**
Attendance	Attendance	Regularity and Punctuality	**05**
ESE		Basic, conceptual and analytical knowledge of the subject	**50**
		Total	**100**

Course Plan

Class Name : 3CMS **Subject Name : REAL ANALYSIS**

Subject Code : MAT331 **Teacher Name : SANGEETHA.SHATHISH**

Planned Date	No of Hours	Unit	Heading	Details	Method	Reading/Ref
29/05/2018 02/06/2018	3.00	Unit-1	Sets and Sequences in R	Open sets, Closed sets, closure of a set,	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
04/06/2018 09/06/2018	4.00	Unit-1	Sets and Sequences in R	countable and uncountable sets, topology of real line. Sequences: Definition of Sequences,	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
11/06/2018 16/06/2018	3.00	Unit-1	Sets and Sequences in R	limit of a sequence, algebra of limits of a sequence,	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005

18/06/2018 23/06/2018	4.00	Unit-1	Sets and Sequences in R	convergent, divergent and oscillatory sequences, problems thereon	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
25/06/2018 30/06/2018	3.00	Unit-1	Sets and Sequences in R	Bounded sequences, Monotonic sequences and their properties, Cauchy sequence.	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
02/07/2018 07/07/2018	4.00	Unit-2	Infinite Series	Infinite series, Cauchy convergence criterion for series	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
09/07/2018 14/07/2018	4.00	Unit-2	Infinite Series	geometric series, comparison test,	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
16/07/2018 21/07/2018	4.00	Unit-2	Infinite Series	convergence of p-series,	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
23/07/2018 28/07/2018	4.00	Unit-2	Infinite Series	D'Alembert's Ratio test,	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
30/07/2018 04/08/2018	3.00	Unit-2	Infinite Series	Raabe's test,	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
13/08/2018 18/08/2018	4.00	Unit-2	Infinite Series	Cauchy's Root test, alternating series,	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
20/08/2018 25/08/2018	3.00	Unit-2	Infinite Series	Leibnitz?s test.	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
27/08/2018 01/09/2018	3.00	Unit-2	Infinite Series	Definition and examples of absolute and conditional convergence.	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
03/09/2018 08/09/2018	4.00	Unit-3	Sequence and Series of functions	Sequences and series of functions, Pointwise and uniform convergence.	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
10/09/2018 15/09/2018	4.00	Unit-3	Sequence and Series of functions	Mn-test, M-test, Statements of the results about uniform convergence	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
17/09/2018 22/09/2018	3.00	Unit-3	Sequence and Series of functions	Power series and radius of convergence.	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005
24/09/2018 29/09/2018	3.00	Unit-3	Sequence and Series of functions	Power series and radius of convergence.	Lecture/Problem solving.	TS.C.Malik and Savita Arora,Mathematical Analysis,second edition,New Delhi, Age International(P) Ltd 2005

CIA 1

Component/Task 1

CIA Details

Written Assignment on applications of Sequence and Series be completed before 30/06/18)

(20 marks)This is an individual hand written assignment with a minimum of 1500 words with references. Plagiarism will not be entertained; if found the student will be asked to resubmit the assignment.

CIA Details will display form 11/06/2018

Learning Objective

Assignment Learning Objectives: After the completion of the assignment, students would be able to recall the concepts of Sequence and Series and also use them to solve real life problems. **Assesment Strategies aligned to LO:** reports,essays and presentations**Technology Tools used along with their Purpose:** white board, Moodle

Assignment Learning Objectives: After the completion of the assignment, students would be able to recall the concepts of Sequence and Series and also use them to solve real life problems. **Assesment Strategies aligned to LO:** reports,essays and presentations**Technology Tools used along with their Purpose:** white board, Moodle

Evaluation Rubrics

Evaluation Rubric:

20	• *Assignment is complete* • *Assignment answer are extremely accurate* • *Assignment is submitted on time* • *Assignment is legible* • *Assignment is submitted in the prescribed format*
16	• *Assignment is mostly complete* • *Assignment is almost accurate* • *Assignment is submitted on time* • *Assignment is legible* • *Assignment is submitted in the prescribed format.*
14	• *Assignment is partially complete* • *Assignments answers are partially accurate* • *Assignment is submitted late (1 day)* • *Assignment is somewhat legible* • *Assignment is submitted in the prescribed format*
10	• *Assignment is mostly incomplete* • *Assignments answers are mostly incorrect* • *Assignment is submitted late (more than 1 day)* • *Assignment is somewhat legible* • *Assignment is not submitted in the prescribed format*

2	
2	
2	

Component/Task 2

CIA Details

Online/Class Test on sequence, limit of a sequence and convergence of sequence.(to be completed before 10/07/18) The test is for 20 marks and the topic of study is **sequence, limit of a sequence and convergence of sequence.** The question paper consists of 20 multiple choice questions of one mark each.

CIA Details will display form 11/06/2018

Learning Objective

Assignment Learning Objectives:*Conceptual understanding of sequence , limit of a sequence and convergence of sequence and relevant problem solving skills.* **Assessment Strategies aligned to LO:** Class test**Technology Tools used along with their Purpose:** Moodle
Assignment Learning Objectives:*Conceptual understanding of sequence , limit of a sequence and convergence of sequence and relevant problem solving skills.* **Assessment Strategies aligned to LO:** Class test**Technology Tools used along with their Purpose:** Moodle

Evaluation Rubrics

Evaluation Rubric:*1: Right answer 0: Wrong answer*

CIA 3

Component/Task 1

Learning Objective

Assignment Learning Objectives: After the completion of the topic review students are able to• List the basic notions of given topic.• Elaborate the given topic in depth. **Assessment Strategies aligned to LO:** Reports**Technology Tools used along with their Purpose:** Moodle
Assignment Learning Objectives: After the completion of the topic review students are able to• List the basic notions of given topic.• Elaborate the given topic in depth. **Assessment Strategies aligned to LO:** Reports**Technology Tools used along with their Purpose:** Moodle

Evaluation Rubrics

o Ecvaluation Rubric:Submission of library assignment in the prescribed format-5 markso Submission of assignment on time-2 markso Review of the topic-5 marks o Library assignment should be well organized and legible-3 marks o Understanding the depth of the topic-5 marks

Component/Task 2

Learning Objective

Assignment Learning Objectives: After the completion of the test Students are able to• Understand and solve problems involving infinite Series. Develop the effective problem solving and logical skills.•

Assessment Strategies aligned to LO: Class Test**Technology Tools used along with their Purpose:** Black board

Assignment Learning Objectives: After the completion of the test Students are able to• Understand and solve problems involving infinite Series. Develop the effective problem solving and logical skills.•

Assessment Strategies aligned to LO: Class Test**Technology Tools used along with their Purpose:** Black board

Evaluation Rubrics

Rubric for each Question:o Completion of answer to the given questions:(4 marks)o 85% and above-4 points.o 60% to below 85%-3points.o 40% to below 60%-2points.o Less than 40%-1pointso No attempt-0points.