



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI-34 DEPARTMENT OF MATHEMATICS-SHIFT II

A REPORT ON THE ONLINE *Workshop on Mathematical Analysis*



MATANA 2021

(13 – 18 September 2021)

Objective

The online Workshop on Mathematical Analysis (MATANA 2021) was organized to strengthen the knowledge of mathematical analysis of postgraduate students, research scholars, interested young college teachers and advanced undergraduate students with the moral and the financial support of the management of Loyola College, Chennai, as a continuation of the online workshop on Mathematical Analysis (MATANA 2020) that was organized in the year 2020 for the young college teachers and students.

Inauguration

The inaugural function of the workshop MATANA 2021 was held on 13th September 2021. Dr. J. Janet Sheeba, Coordinator of the Department welcomed the officials, resource persons, and participants both teachers and students who were present in the inaugural function. Dr. C. Ganesa Moorthy, Retired Professor of Mathematics, Alagappa University, Karaikudi, inaugurated the workshop with an inaugural address mentioning the importance of mathematical analysis. Dr. Melchias Gabriel, Deputy Principal, Loyola College felicitate the workshop, and the keynote address was delivered by Dr. D. Antony Xavier, Head of the Department of Mathematics during which he explained the importance of Real analysis and its beautiful properties. The overview of the workshop MATANA 2020, organized in the previous year 2020 was shared in the form of video presentation during the inaugural function. Dr. J. Geno Kadwin, convener of the workshop outlined the dynamics of the workshop to the participants, and the vote of thanks was proposed by Dr. S. Iruthaya Raj, convener of MATANA 2021.

Resource persons

The following eminent resource persons were invited to handle the technical sessions of the workshop.

Dr. R. Lawrence Joseph Manoharan

Former Head, PG and Research Department of Mathematics
St. Joseph's College (Autonomous)
Tiruchirappalli-620002
Tamil Nadu

Dr. M. Marudai

Honorary Professor
Department of Mathematics
Bharathidasan University
Tiruchirappalli-620020
Tamil Nadu

Dr. C. Ganesa Moorthy

Retired Professor
Department of Mathematics
Alagappa University
Karaikudi-630004
Tamil Nadu

Dr. P. S. Srinivasan

Associate Professor
Department of Mathematics
Bharathidasan University
Tiruchirappalli-620020
Tamil Nadu

Dr. S. V. Bharanedhar


Assistant Professor
Department of Mathematics
Central University of Tamil Nadu
Thiruvarur
Tamil Nadu

Platform of the workshop

The workshop was conducted through Cisco WebEx platform licensed to Loyola College, Chennai. The inaugural function, workshop sessions and the valedictory function were held in the platform only.

Technical sessions

During the workshop days from 13-18 September 2021, there were 3 technical sessions held per day from 4:45 pm to 7:00 pm of 45 minutes of duration each. Totally 16 technical sessions were handled by the resource persons during the workshop excluding the inauguration and valediction programmes. The following was the overall schedule of the sessions.

	Session-1 [4:45 pm– 5:30 pm]	Session-2 [5:30 pm– 6:15 pm]	Session-3 [6:15 pm – 7:00 pm]
Day-1 13-09-2021	Inauguration	RLJ	PSS
Day-2 14-09-2021	RLJ	PSS	PSS
Day-3 15-09-2021	RLJ	PSS	MM
Day-4 16-09-2021	MM	PSS	PSS
Day-5 17-09-2021	SVB	SVB	CG
Day-6 18-09-2021	SVB	SVB	Valediction

Resource person

RLJ Dr. R. Lawrence Joseph Manoharan

MM Dr. M. Marudai

CG Dr. C. Ganesa Moorthy

PSS Dr. P. S. Srinivasan

SVB Dr. S. V. Bharanedhar

Topic

Real Analysis

Topology of metric spaces

Invariant subspace problem in matrix form

Sequence of functions

Analytic functions and complex integration

Dr. Lawrence Joseph Manoharan explained the concepts of “Limit of a sequence”, “Continuity” and “Differentiability” during his sessions. He solved some problems related to the above topics appeared in the CSIR-NET qualifying exam for lectureship and for junior research fellow conducted in the past years in Mathematical Sciences. PG students and others who practice for NET shared the usefulness of the sessions in the feedback.

Dr. P. S. Srinivasan in his sessions explained in detail the concept of sequence of functions, its point-wise and uniform convergence. He gave many examples and explained fundamental notion and various important results in analysis which are useful to solve the problems on sequences of functions. He illustrated the concepts and related examples using geometry also. Many participants appreciated the approach of the speaker and gave positive feedback on his sessions.

Dr. M. Marudai’s sessions focused on the fundamental concepts of Topology of metric spaces during which he explained different metrics and corresponding open balls. The sessions were useful to the students who are interested in learning mathematical analysis.

Dr. S. V. Bharanedhar explained the concepts of analyticity of complex valued functions and induced the participants to refresh their knowledge in complex analysis. He discussed the power series of analytic functions and also he gave some inputs to evaluate complex integration. The sessions were planned to provide fundamental skills to solve problems on analyticity of complex functions that are often asked in the CSIR-NET.

Dr. C. Ganesa Moorthy introduced to the participants the prestigious open problem called “Invariant subspace problem” of Hilbert. He approached the problem with matrix theory and motivated the participants to find the solution of the open problem. His session would benefit the research scholars in their research in analysis.

Quizzes and exercises

Some mathematical problems on the topics discussed during the technical sessions were given to the participants through Google Classroom for practice, and quizzes were conducted through Google forms during the workshop days. The materials given by the resource persons were also circulated to the participants.

Valediction

The valedictory function of the workshop on MATANA 2021 was held on 18 September 2021 from 6:15 pm to 7:00 pm. The welcome address was delivered by Dr. J. Geno Kadwin, convener of MATANA 2021. Dr. Dorathy Pushparani, Vice Principal (Administration), Shift-II, Loyola College, Chennai, was the president of the valedictory function and she briefed out about the workshop and appreciated the department and the active participants of the workshop. Dr. Indra Rajasingh, Former Head, Department of Mathematics, Loyola College, Chennai, and Former Dean, School of Advanced Sciences, VIT Chennai was the chief guest of the function and delivered the valedictory address. She appreciated the department and the organizers for organizing the workshop on Mathematically Analysis and she also shared the importance of learning mathematical analysis. Vote of thanks was proposed by Dr. S. Iruthaya Raj, convener of MATANA 2021.

Participants

The number of registered participants was 697 among whom 195 were college teachers and 502 were students of UG, PG, M. Phil. and research programmes, in the field of Mathematics from various states and territories of India. The participants have given positive feedback on the conduct of the workshop. They have recorded their views, expectations and ideas to improve the workshop in the upcoming years. Their valuable suggestions will be useful to improve the objective of the workshop. The active participants were given participation e-certificates.

Expected outcome

The participants will gain knowledge in the field of mathematical analysis. This workshop will be beneficial to the young college teachers, research scholars, post graduate students and advanced learning undergraduate students to improve their

problems solving ability in mathematical analysis. It is also expected that this workshop will be useful to the participants in clearing the NET/SET in the field of Mathematical Sciences.

Photo Gallery

Inaugural function (13 September 2021)



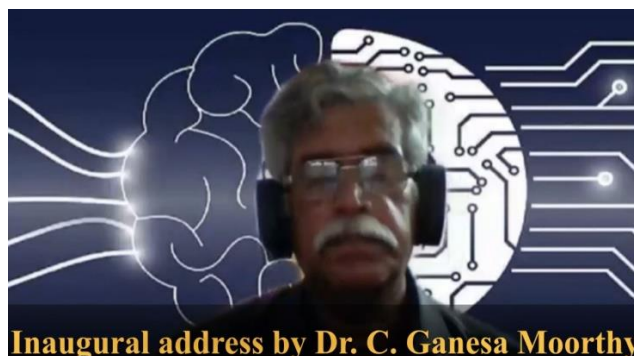
Dr. J. Janet Sheeba, Coordinator
(Welcome address)



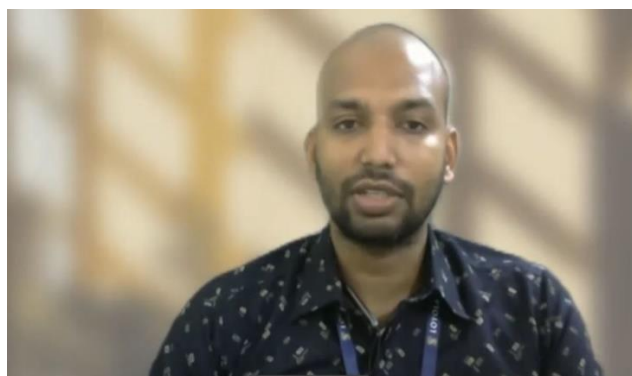
Dr. Melchias Gabriel, Deputy Principal
(Felicitation)



Dr. D. Antony Xavier, Head of the Department
(Keynote address)



Inaugural address by Dr. C. Ganesa Moorthy
(Inaugural address)



Dr. J. Geno Kadwin, Convener
(Dynamics of the Workshop)



Dr. S. Iruthaya Raj, Convener
(Vote of thanks)

Resource persons



Dr. R. Lawrence Joseph Manoharan

$$\begin{aligned} \lim_{n \rightarrow \infty} \frac{(1 + \frac{1}{2n}) - \frac{1}{n}}{(\frac{1}{n^2} + \frac{1}{n})^{\ln n} \cdot \log n} \\ = \lim_{n \rightarrow \infty} \frac{1 + \frac{1}{2n} - \frac{1}{n}}{\log n} \cdot \lim_{n \rightarrow \infty} \frac{1}{(\frac{1}{n^2} + \frac{1}{n})^{\ln n}} \\ = 1 \times \frac{1}{e} \\ = \frac{1}{e} \end{aligned}$$



Dr. P. S. Srinivasan

3) $f_n(x) = \begin{cases} 1 & \text{if } |x| \leq n \\ 0 & \text{if } |x| > n \end{cases}, f(x) = 1$

$f_n \rightarrow 1$ on \mathbb{R}

Suppose $f_n \rightarrow f$ on \mathbb{R}

$\epsilon = \frac{1}{2}, \forall N \in \mathbb{N}, \forall x \in \mathbb{R}, |f_n(x) - 1| < \frac{1}{2}$

$\forall x \in \mathbb{R}, f_n(x) \in (\frac{1}{2}, \frac{3}{2})$

$\forall x \in \mathbb{R}, f_n(x) > \frac{1}{2} \quad \text{--- } \odot$



Dr. M. Marudai

$$\sum_{n=0}^{\infty} a_n (z - z_1)^n = \frac{1}{1 - \lambda(z - z_1)}$$

$\lambda = -1$



Dr. S. V. Bharanedhar

POWER SERIES

$z_n \rightarrow 0, |z_n| \rightarrow$

DEFINITION

A series of the form $\sum_{n=0}^{\infty} a_n (z - a)^n$ is called power series about $z = a$.

$\sum_{n=0}^{\infty} a_n z_1^n$ at $z = z_1$ is not always defined. $\forall z \rightarrow |z| < |z_1|$

$a_n z_1^n \rightarrow 0, |a_n z_1^n| \rightarrow$

DM

$$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix} = \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix}$$

$$y_i = a_{i1}x_1 + a_{i2}x_2 + \dots + a_{in}x_n$$

Convergence is not required. Algebra

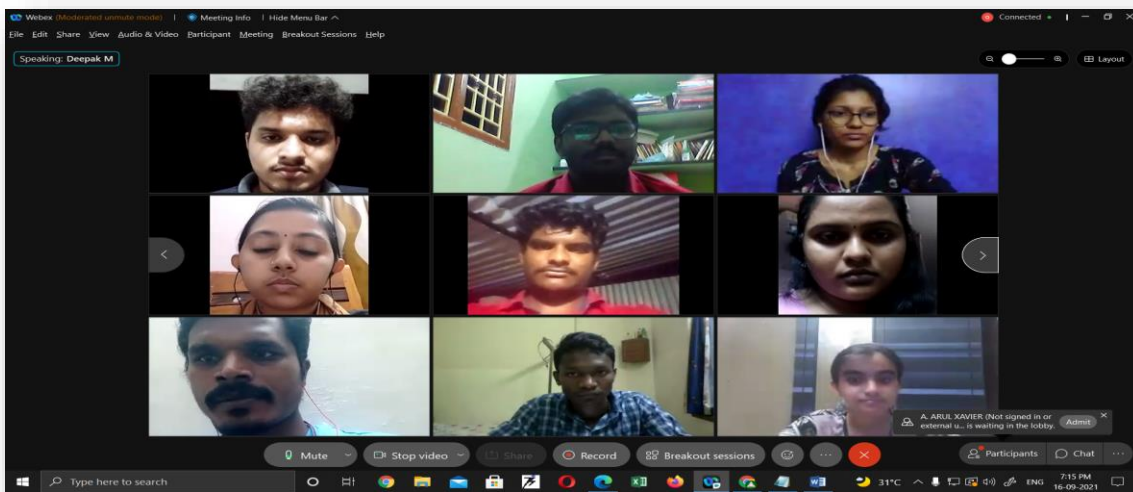
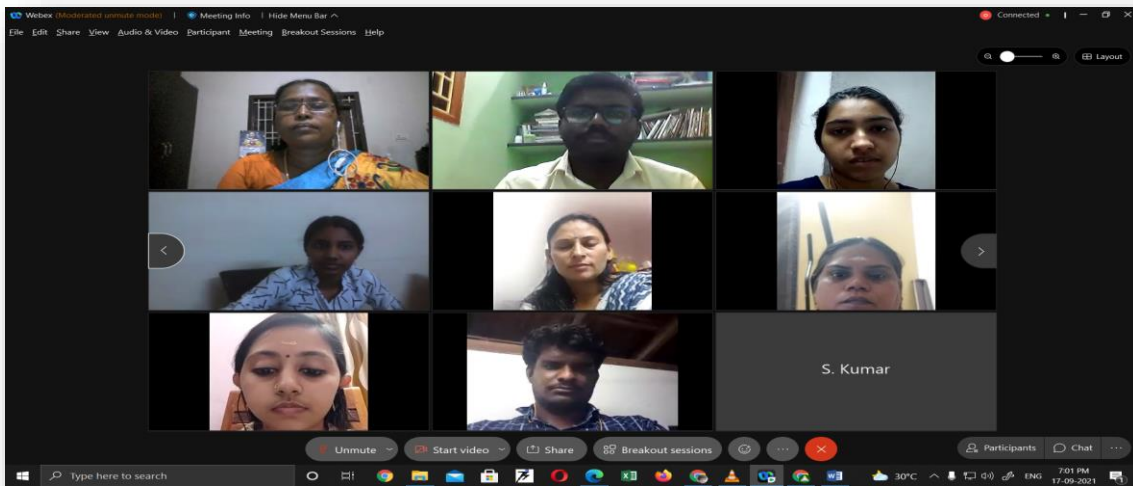
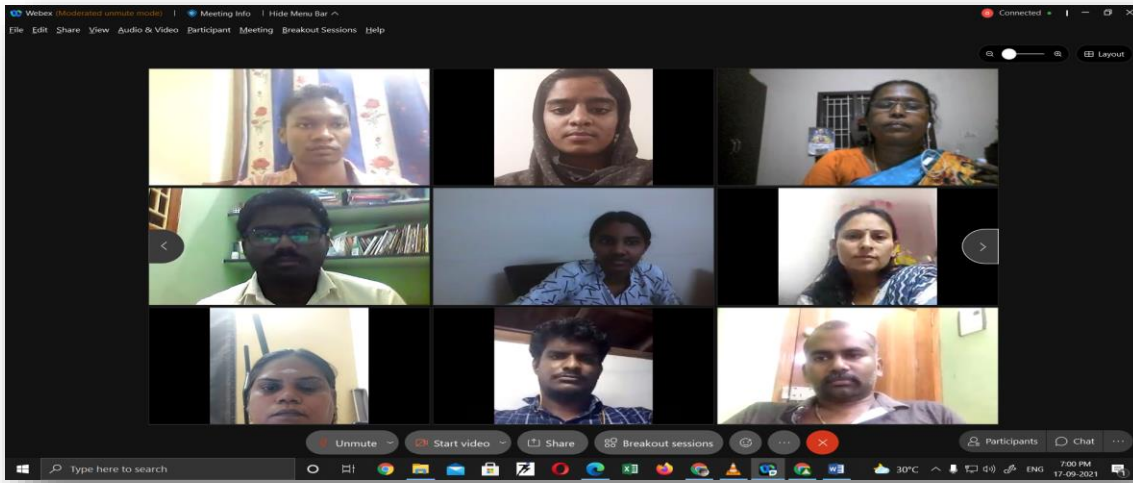
Dr. C. Ganesa Moorthy

Open Problem: Find necessary and sufficient conditions (if and only if conditions or characterization) for infinite matrices to map ℓ_2 into ℓ_2 .

Find conditions for a_{ij} so that

$$\begin{pmatrix} a_{11} & a_{12} & \dots & \dots \\ a_{21} & a_{22} & \dots & \dots \\ \vdots & \vdots & \ddots & \vdots \\ \vdots & \vdots & \dots & \dots \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ \vdots \end{pmatrix} \in \ell_2, \text{ whenever } \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ \vdots \end{pmatrix} \in \ell_2$$

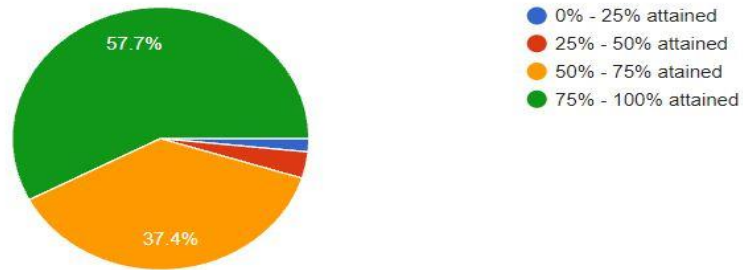
Participants



Feedback from the participants

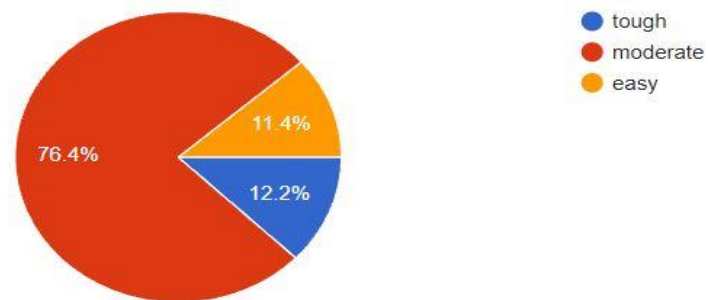
Rate the attainment of your expectation with MATANA 2021.

123 responses



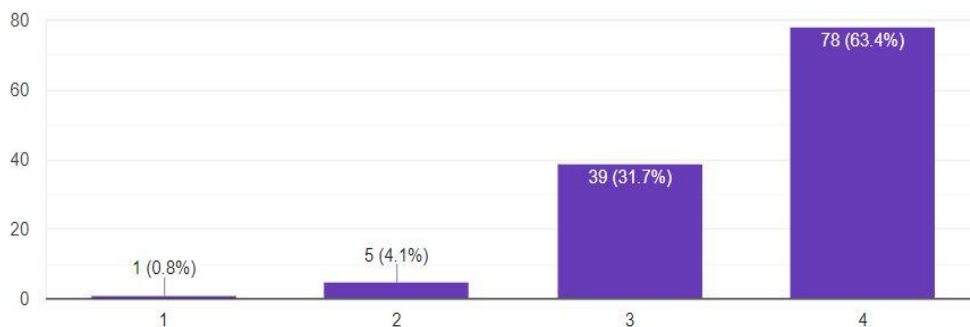
The exercise problems given by the resource persons to solve were

123 responses



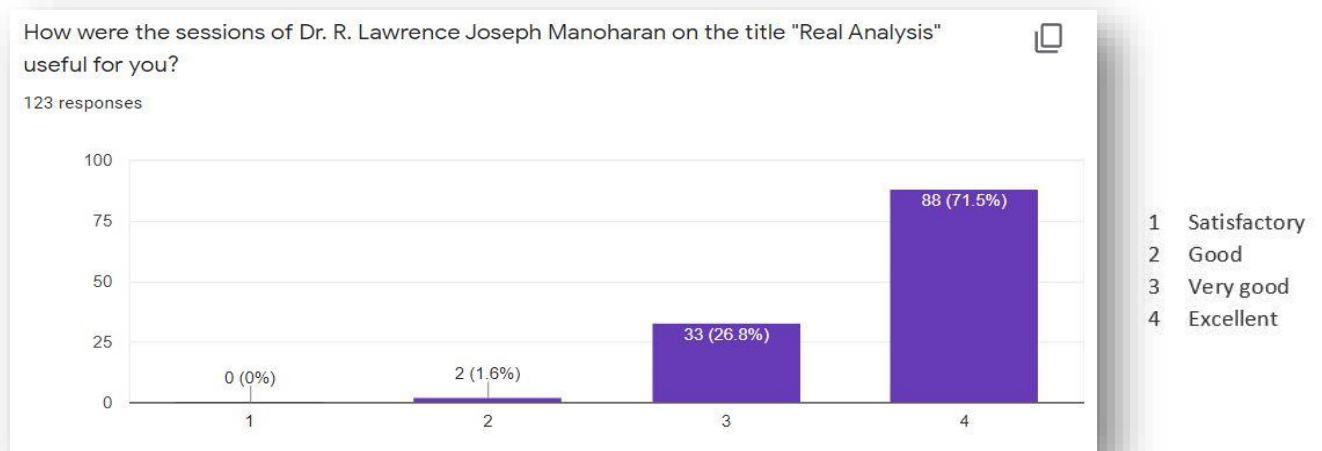
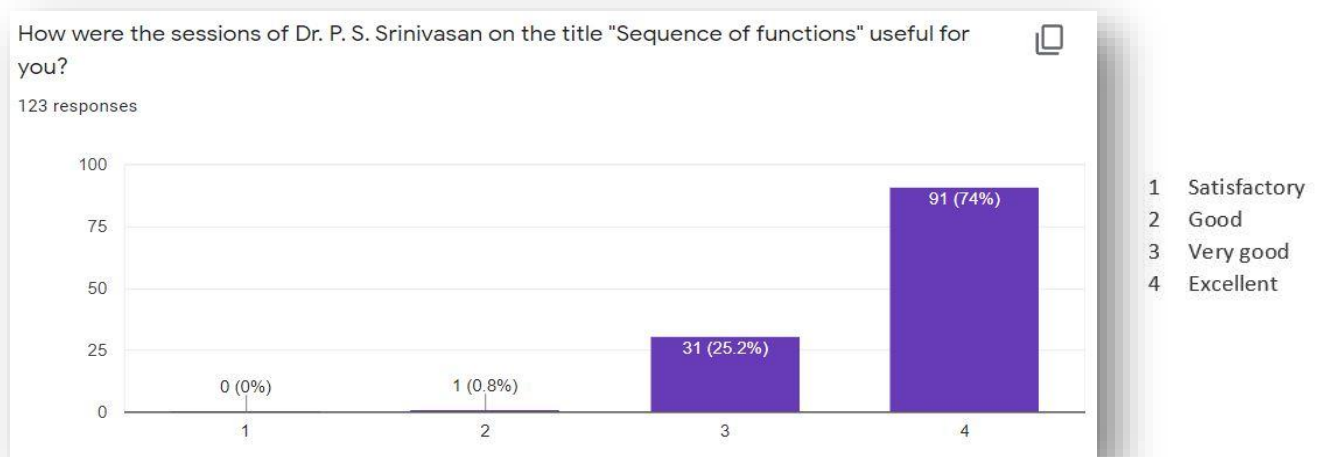
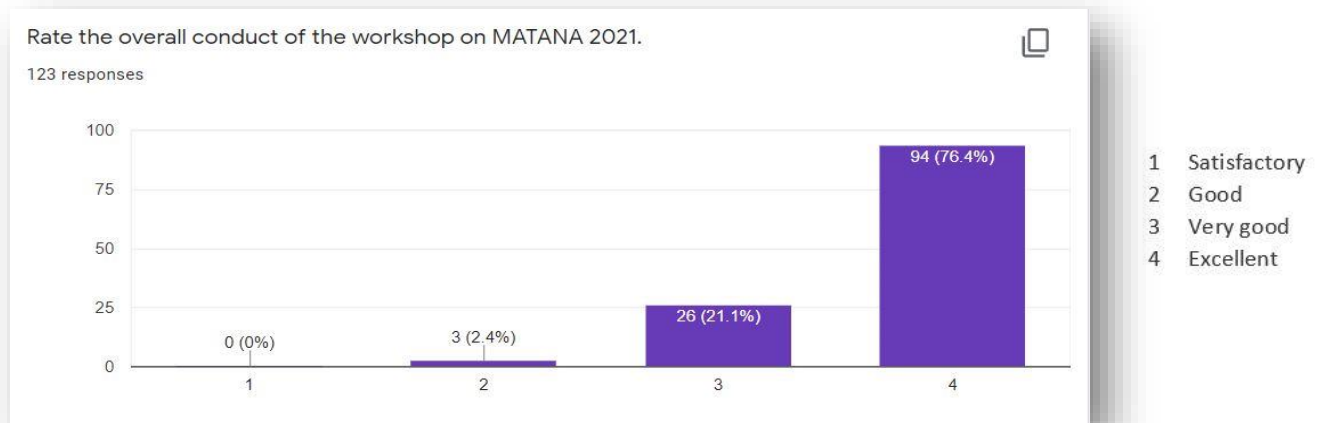
Rate the quality of audio/video/presentation in Cisco WebEx platform during MATANA 2021.

123 responses



- 1 Satisfactory
- 2 Good
- 3 Very good
- 4 Excellent

Feedback from the participants

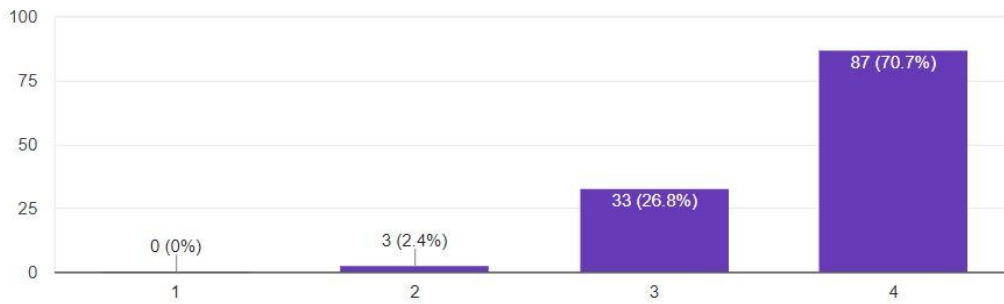


Feedback from the participants

How were the sessions of Dr. M. Marudai, on the title "Topology of metric spaces" useful for you?



123 responses

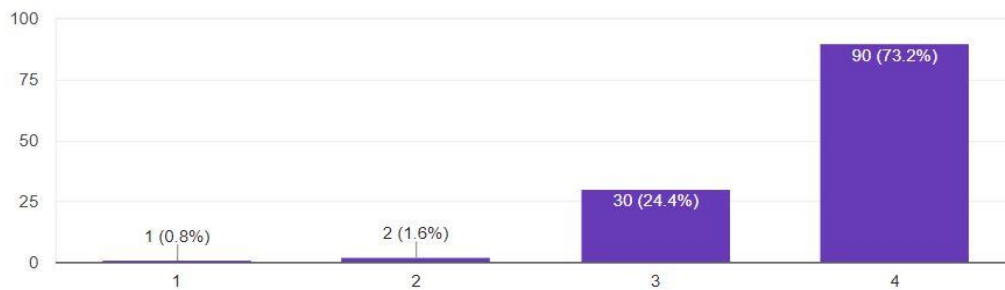


- 1 Satisfactory
- 2 Good
- 3 Very good
- 4 Excellent

How were the sessions of Dr. S. V. Bharanedhar, on the title "Analytic functions and complex integration" useful for you?



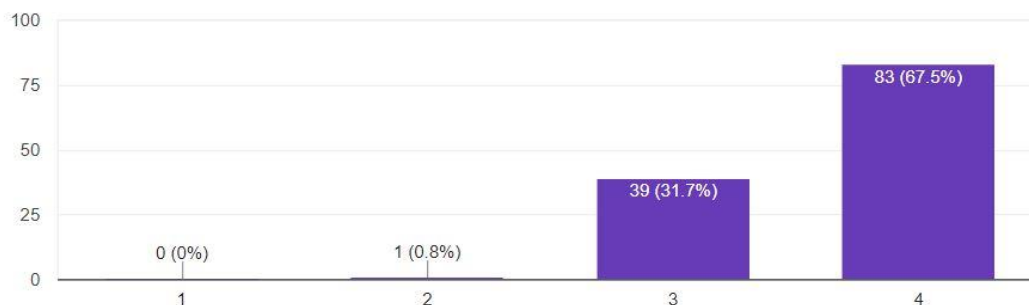
123 responses



- 1 Satisfactory
- 2 Good
- 3 Very good
- 4 Excellent

How was the session of Dr. C. Ganesa Moorthy, on the title "Invariant subspace problem in matrix form" useful for you?

123 responses



- 1 Satisfactory
- 2 Good
- 3 Very good
- 4 Excellent

Feedback from the participants

Very good

We expect more workshops like this for expanding our knowledge

Complete Complex Analysis will be very helpful for the young scientist

Great session, Welldone.

Send the presentations through mail for future reference. Kindly do the needful. Thank you so much conveners.

Excellent

Overall workshop was very good

Wish you all the best

Very nice presentation

Research orientated events

Thanks for creating this wonderful opportunity.

Such a wonderful workshop. Actually I don't expect this much amount bright lectures which I have seen. All lectures are so beautiful and most valuable, particularly, Prof Srinivasan sir and Prof Bhanedhar sir lectures are most valuable for me, I learned a lot of knowledge from their lectures. Thank you so much for providing such a wonderful workshop. Once again I would like to thank all the professors(speakers) and organizing committee.

Nice session

Nice session

-

Could concentrate on NET syllabus

Maruthai sir voice is very low...I couldn't hear his voice properly.

All is good

Overall very nice

Thank you For the webinar

Evaluation marks should also be intimidated.

Valedictory function (18 September 2021)



Dr. J. Geno Kadwin
(Welcome address)



Dr. Dorathy Pushparani
(Presidential address)



Dr. Indra Rajasingh
(Valedictory address)



Dr. S. Iruthaya Raj
(Vote of thanks)

Organizing committee

Rev. Dr. P. Francis Xavier, SJ
Rev. Dr. D. Selvanayakam, SJ
Rev. Dr. A. Thomas, SJ
Dr. Melchias Gabriel
Dr. D. Antony Xavier
Dr. J. Janet Sheeba
Dr. S. Iruthaya Raj
Dr. J. Geno Kadwin

Rector
Secretary and Correspondent
Principal
Deputy Principal
Head of the Department
Coordinator of the Department
Convener
Convener



LOYOLA COLLEGE, CHENNAI-34
DEPARTMENT OF MATHEMATICS SHIFT II

welcomes you to the inauguration of

ONLINE WORKSHOP ON
MATHEMATICAL ANALYSIS



CHIEF GUEST

Dr. C. Ganesa Moorthy

Retired Professor of Mathematics
Alagappa University, Karaikudi

FELICITATION

Dr. Melchias Gabriel

Deputy Principal, Loyola College, Chennai

KEYNOTE ADDRESS

Dr. D. Antony Xavier

Head, Department of Mathematics, Loyola College, Chennai

13 SEPTEMBER 2021 AT 4:45PM

CISCO WEBEX MEETING LINK

[https://loyolachennai.webex.com/loyolachennai/j.php?
MTID=mb6335d7d922d99838d39452fd9d8ac02](https://loyolachennai.webex.com/loyolachennai/j.php?MTID=mb6335d7d922d99838d39452fd9d8ac02)

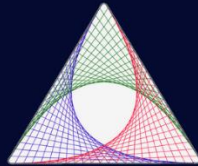
Meeting number: 2643 170 8484 Password: Loyola



LOYOLA COLLEGE, CHENNAI-34
DEPARTMENT OF MATHEMATICS SHIFT II

welcomes you to the valedictory function of

Online Workshop on
MATHEMATICAL ANALYSIS



MATANA 2021

Presidential Address

Dr. Dorathy Pushparani

Vice Principal (Administration, Shift II), Loyola College, Chennai

Valedictory Address

Dr. Indra Rajasingh

Former Head, Department of Mathematics, Loyola College, Chennai
Former Dean, School of Advanced Sciences, VIT Chennai

Date: 18 September 2021 Time: 06.15pm

Cisco WebEx Meeting Link

[HTTPS://LOYOLACHENNAI.WEBEX.COM/LOYOLACHENNAI/J.PHP?
MTID=MB6335D7D922D99838D39452FD9D8AC02](https://LOYOLACHENNAI.WEBEX.COM/LOYOLACHENNAI/J.PHP?MTID=MB6335D7D922D99838D39452FD9D8AC02)

Meeting Number: 2643 170 8484

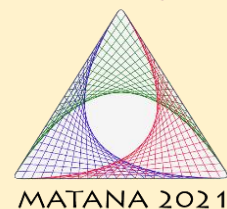
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LOYOLA COLLEGE (AUTONOMOUS)
DEPARTMENT OF MATHEMATICS SHIFT-II
CHENNAI-600034, TAMIL NADU, INDIA

Online

Workshop on Mathematical Analysis



13 - 18 September 2021

About the college

Loyola College, Chennai run by the Society of Jesus was established in the year 1925 with 75 undergraduate students of Mathematics, History and Economics. Loyola College was given autonomy in 1978 and was honoured with "College with Potential for Excellence" in 2010 and "College of Excellence" from 2014 onwards. Loyola was ranked 6th among Arts and Science Colleges in India by National Institute Ranking Framework (NIRF) in the years 2018, 2019 and 2020, and has been accredited with CGPA of 3.55 on four point scale at A⁺⁺ grade by NAAC in 2021. Around 9500 students are studying in 19 post graduate and 24 under graduate departments, and Research is carried out in 12 departments. Loyola provides quality education, incredible compendium of academic programmes, innovative methodologies and intensive research to the students.

About the department

Department of mathematics was established in the year 1925 with B.A. program in mathematics. The Honors course in mathematics was integrated in 1927 and the first batch of students appeared for the B.A. Honors degree in 1930. The department was recognized as a research department in 1984. The Racine Research Centre was established in the department in 1991 on the occasion of the birth centenary of Rev. Fr. Charles Racine D.Sc., who was one of the big influences in the development of modern mathematics in India. The mathematicians M. S. Narasimman FRS and C. S. Seshadri FRS, founder and director emeritus of the Chennai Mathematical Institute are the alumni of the department who are known for the famous Narasimman-Seshadri theorem. Department of mathematics was extended in the evening college in the year 1978 and Department of Mathematics Shift-II was established in the year 2005.

About the workshop

The workshop on Mathematical Analysis (MATANA 2021) is organized for PG students, M.Phil. and Research scholars, and interested young college teachers of mathematics stream. Interested senior undergraduate students can also participate. This workshop covers some interesting topics in mathematical analysis and is framed to enrich analytical skills and problem solving ability of students, research scholars and young college teachers. It is expected that this workshop will be beneficial to the participants to solve certain problems of analysis in eligibility tests like SET/CSIR NET and etc.

- ❖ Interested students and teachers are encouraged to participate
- ❖ No registration fee and only limited seats are available
- ❖ The last date for the registration is 10th September 2021
- ❖ e-Certificates will be issued to the active participants

Resource persons

The following eminent professors in the field of mathematical analysis are going to handle the sessions of the workshop MATANA 2021. The speakers will induce new techniques of mathematical analysis during the workshop.

Dr. R. Lawrence Joseph Manoharan

Former Head, Department of Mathematics
St. Joseph's College (Autonomous),
Tiruchirappalli, Tamil Nadu, India

Real analysis



Dr. M. Marudai

Honorary Professor, Department of Mathematics
Bharathidasan University, Tiruchirappalli,
Tamil Nadu, India

Topology of metric spaces



Dr. P. S. Srinivasan

Associate Professor, Department of Mathematics
Bharathidasan University, Tiruchirappalli,
Tamil Nadu, India

Sequence of functions



Dr. S. V. Bharanedhar

Assistant Professor, Department of Mathematics,
Central University of Tamil Nadu,
Thiruvavur, Tamil Nadu, India

Analytic functions and complex integration



Organizing committee

Rev. Dr. Francis P Xavier SJ, Rector

Rev. Dr. D. Selvanayakam SJ, Secretary and Correspondent

Rev. Dr. A. Thomas SJ, Principal

Dr. Melchias Gabriel, Deputy Principal

Dr. D. Antony Xavier, Head of the Department

Dr. J. Janet Sheeba, Coordinator of the Department

Conveners

Dr. S. Iruthaya Raj and Dr. J. Geno Kadwin

Advisory committee

Dr. S. Athisayanathan, COE, St. Xavier's College, Palayamkottai

Dr. T. Pathinathan, Retired Professor, Loyola College, Chennai

Dr. C. Ganesa Moorthy, Retired Professor, Alagappa University

Faculty members

Dr. T. Bharathi, Assistant Professor

Mr. F. R. Emmanuel, Assistant Professor

Mr. A. Christopher, Assistant Professor

Mr. D. Kumanan, Assistant Professor

Dr. S. Ruth Julie Kavitha, Assistant Professor

Dr. S. Maria Jesu Raja, Assistant Professor

Registration link

<https://forms.gle/brJgxMHYPSNCSgNY6>

Contact details

9952229890 (Dr. S. Iruthaya Raj)

9894131838 (Dr. J. Geno Kadwin)

Email address: matana@loyolacollege.edu

For further updates visit the website

<https://sites.google.com/loyolacollege.edu/matana2021>