UGC Human Resource Development Centre

Pt. Ravishankar Shukla University, Raipur

ज्ञान-विज्ञान विमुक्तये

ONLINE

Refresher Course in Mathematics

January10 to 22, 2022

Report

Name of Course/Program	Refresher Course in Mathematics
Name of Contact person from HRDC	Dr. Arvind Agrawal Assistant Professor Human Resource Development Centre Pt. Ravishankar Shukla University, Raipur
Date of Course/Program	10/01/2022 to 22/01/ 2022
Name of Course Coordinator	Prof. Balwant Singh Thakur Head School of Studies in Mathematics Pt. Ravishankar Shukla University, Raipur
Theme of Course/Program	Fundamental and Advance Topics in Mathemaitcs
Number of Participants	31
State wise number of participants:	Chhattisgarh–08, Gujarat–01, Jammu & Kashmir-01, Kerala-01, Maharashtra-03, Tamilnadu-06, Uttar Pradesh–01, West Bengal–10
Gender wise number of participants:	Male: 23, Female: 08
Number of Resource Persons	19
Signature of the Course Coordinator	

Online Platform		
Zoom meeting	Meeting ID: 963 9691 0852	Passcode: 256838
Google Meet	meet.google.com/jqf-wzwv-tuu	

Organizing Team

Prof. K. L. Verma
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Pt. RSU, Raipur (C.G.)

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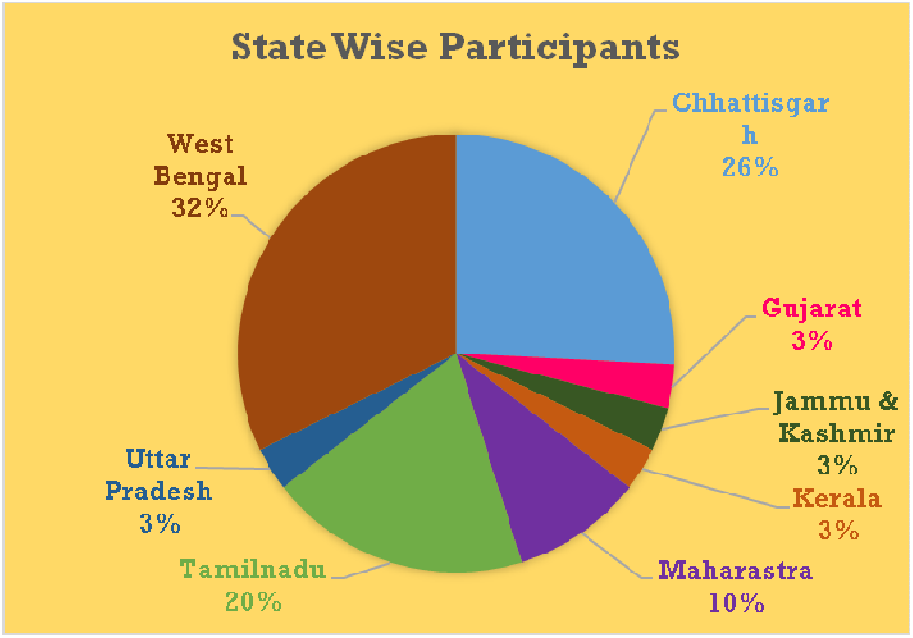
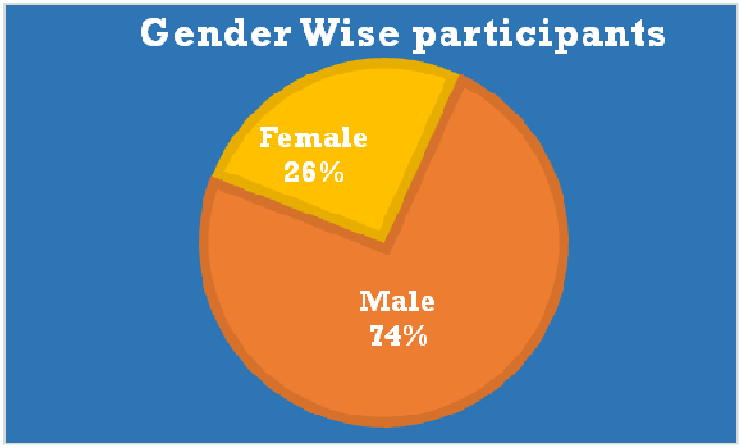
Refresher Course inMathematics

(10/01/2022 - 22/01/2022)

A RefresherCourse in "Mathematics" was organized by Human Resource Development Centre, Pt. Ravishankar Shukla University Raipur, in collaboration with School of Studies in Mathematics, Pt. RavishankarShukla University, Raipur from 10th -22nd, January 2022. The course was attended by Thirty-Three registered participants from across the country. 28outstations and 03 local participants attended the same. 19 resource persons from 12 states delivered lectures.



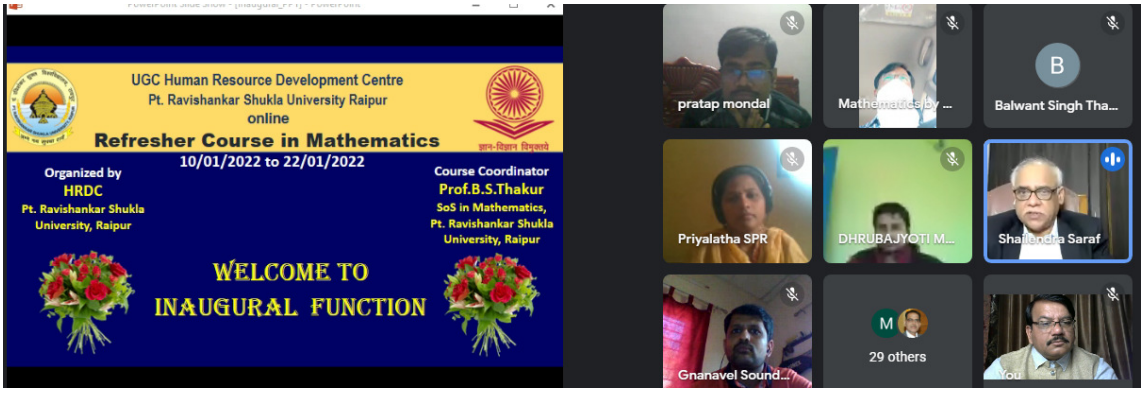


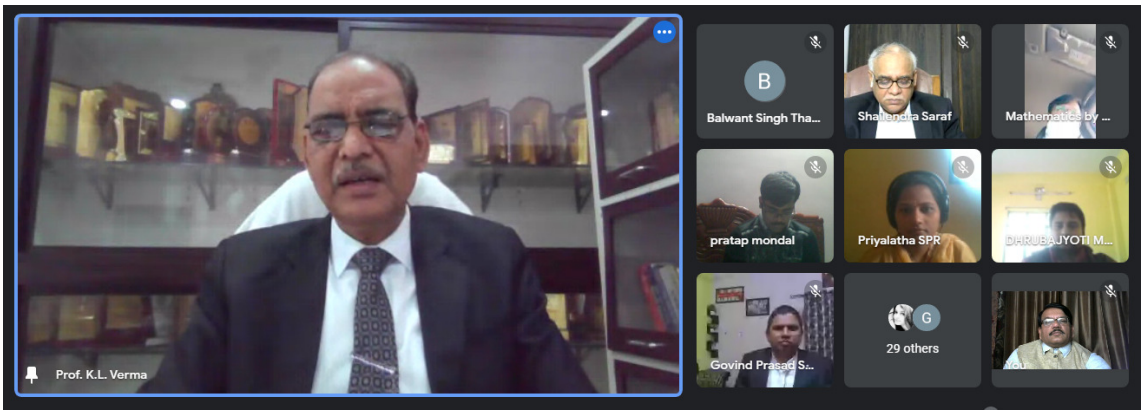
DAY 1 (10/01/2022)

Session I (10:30-12:00)Inaugural Function

The Program commenced on the Google Meet Platform with the Inaugural Function at 10.00 a.m.with **Chief Guest as Hon'ble Vice-Chancellor Prof. K L Verma, Pt.Ravishankar Shukla University, Raipur.**With Director - **Prof. ShailendraSaraf, Director, Human Recourse Development Center, PtRavishankar Shukla University, Raipur** and Course Coordinator **Prof. Balwant Singh Thakur, Head, School of Studies in Mathematics, PtRavishankar Shukla University, Raipur.**The Program commenced by welcoming participants and Guests by Dr. Arvind Agrawal (HRDC, Pt RSU), which wasfollowed by brief introduction of each Participants, Introduction about the coursebythe CourseCoordinatorandAddressbytheDirectorHRDC-PtRSU.

Inaugural Address was given by Hon'ble Vice Chancellor, who congratulated course Coordinator for having very good panel of experts across the country for the Refresher Course. Inaugural program ended with vote of thanks by Dr. Arvind Agrawal.





Session II (12:10 to 13:40)

1. **Prof. SudhirRamakantGhorpade** of **Department of Mathematics, Indian Institute of Technology, Bombay, Powai, Mumbai,** spoke on thetopictitled'**Spectral Theorems for Matrices-I**'.

He started talking on Linear Algebra, specially on Simple Eigen value problem along with Eigen Vector. Then he explained extensively about matrix, linear transformation, matrix representation with respect to ordered basis, change of basis, eigen values, eigen vector, algebraic and geometric multiplicity of eigen values, diagonal matrices and related theorems. His lecture was filled with characterization of matrices where he explained algebraic multiplicity and geometric multiplicity in a very lucid manner. The session was very informative and participants actively participated in the session.

Session III (14:20 to 15:50) & Session IV (16:00 to 17:30)

2. **Prof. Kalyan Chakraborty,Director, KSCSTE- Kerala School of Mathematics, Kozhikode Kerala,**delivered lectures on the **Introduction to the 'Theory of Numbers**'.

He has made details discussion by covering all aspects of this subject. At the beginning he discussed about some basic properties of the set of natural numbers which were well ordering principle, successor property, mathematical induction, etc. Then he gave a clear concept of Division algorithm, Divisibility, Prime numbers, Congruence, etc. For this lecture he stated and proved many theorems for complete understanding of the topic.

Prof.Chakroborty elaborately discussed thefollowing subject matters of the topic, which are (i) Greatest common divisor, (ii) Euclid Algorithm, (iii) Relatively prime integers, (iv) Prime integers and related theorems, (v) Fundamental theorem of Arithmetic, (vi) Euclidean theorem, (vii) Quadratic Congruence, (viii) Congruent number, (ix) Fermats little theorem, (x) Eulers's phi function, (xi) Wilsons theorem, (xii)Chines remainder theorem, (xiii) System of congruence equation, etc.

At the last part of his lecture, Prof.Chakroborty focused on some challenging congruent number problems.

DAY 2 (11/01/2022)

Session I (10:30 to 12:00)

3.**Dr. Suparna Sen Gupta, Librarian**of **Pt.Sundar Lal SharmaLibrary, Pt. Ravishankar Shukla University, Raipur,**expressed his views on thetopic'**E-resources**'.

He talked about so many e-resources for study. He explained the advantages of accessing the e-resources. He meticulously explained and demonstrated various technical details for better academic search in internet search engines. He explored the benefits of N-LIST and academic and research resources available in the N-LIST. He explained about E-Shodh Sindhu, E PG Pathashala, Sodh Ganga &ShodhGangotri, E-Gyankosh. He explored in detailed about the National Digital Library Hosted by IIT Kharagpur and invited participants to promote it among college and university students. He also explained about Census Digital Library, scope of its usages and opportunities.

Session II (12:10 to 13:40)

4. **Prof. Sudhir Ramakant Ghorpade** of **Department of Mathematics, Indian Institute of Technology, Bombay, Powai, Mumbai,**spoke on thetopictitled'**Spectral Theorems for Matrices-II**'.

He continued from the previous lecture. He explained criteria for diagonalizable of square real matrix. Gram-Schmidt Orthogonalization process was discussed. He explored unitarily similar matrices and unitarily diagonalizable matrices and related mathematical results. He then proved the Schur's Theorem for linear map. He then explained normal matrix and gave an equivalent criterion in terms of inner product, then he gave a criterion for diagonalizability of complex matrix in terms of normal matrix. He proved the spectral theorem for

normal matrices. Then, self-adjoint matrix was defined and spectral theorem for self-adjoint matrices are established. Finally, he explained spectral theorem for real symmetric matrices.

Session III (14:20 to 15:50)

5. **Prof. D.R. Sahu** of **Department of Mathematics, Banaras Hindu University, Varanasi,** discussed about thetopic'**Optimization via fixed point theory-01**.

He started with the fundamental fixed point theorem and also explained convex optimization's problem and it's uses in various field like mechanical, electrical and computer science engineering. He discussed the various properties of inner product space, matrix space and various preliminary theorems. He covered the topic convex combination, Banach space, Opial's condition, optimization problem, epigraph, phenomenon of convex function etc. He explained the concepts using several examples.

Session IV (16:00 to 17:30)

6. **Dr. Rakesh Jana,** of **Department of Mathematics**
Indian Institute of Technology, Guwahati shed light on "**LaTex: Basics, Mathematics & Table**"

He explained basic concept of LaTex and how to enter overleaf LaTex and various commands of LaTex one by one. He delivered information about how to give title of the section and subsection. Explained the difference between in line mode and display mode with the examples. He discussed various packages and commands. He delivered how to design the table and matrix. The session was lucid and is applicable for every researcher.

DAY 3 (12/01/2022)

Session I (10:30 to 12:00)

7. **Prof. D.R. Sahu** of **Department of Mathematics, Banaras Hindu University, Varanasi,**discussed about thetopic **'Optimization via fixed point theory-02'**.

This was continuation of his first talk. In this talk he clearlyexplained various concepts such as differentiability R_∞ functions, the directional derivative of a function, Gateaux differentiable, Frechet differentiability, Hilbert Space, uniformly convexity, α- strongly convexity. He explains this in a detailed manner with basic definitions, corollary, lemma, and theorems. matrix space and various preliminary theorems. He covered the topic convex combination, Banach space, Opial's condition, optimization problem, epigraph, phenomenon of convex function etc. He explained concepts using several examples.

Session II (12:10 to 13:40)

8. **Dr. Rakesh Jana,**of **Department of Mathematics,Indian Institute of Technology, Guwahati** shed light on **"LaTeX: Figure, References and Citations, Tikz"**.

This was second lecture of Dr. Jana. He explained in detailed the coding of LaTex. He also explained the basics of LaTeX including basic commands, document structure, running and viewing LaTeX numbering list, basic text formatting such as fonts, symbols. He also

explained in the concept like: Including figures, Adding Tables, Adding basic math building blocks, equations, citing the references, and plotting the diagrams using Tikz plot.

Session III (14:20 to 15:50) & Session IV (16:00 to 17:30)

9. **Prof. Sandip Banerjee** of **Department of Mathematics, Indian Institute of Technology, Roorkee**elucidated the topic'**Mathematical Modeling with MATHEMATICA'**

He started his lecture on Prey-Predator equations using some interesting figures. He described their solution using proper transformation. He also analysed the Linear Stability of a Prey-Predator model and their nice mathematical graphs. After that he presented the modified Prey-Predator model. He elaborated the Stage Structure Model and SIR Model of various species. He also nicely presented SIR Model without vaccination and SIR Model with vaccination with their graphical representation. He also told us about the Mathematical Modeling of Hepatitis C Virus and their behaviour also the treatment. He also described the differential equations, mathematical model of the Interferon Monotherapy and Interferon in conjunction with Ribavirin.

In the second lectureProf.Sandip Banerjee started by solving the difficulties to install the software MATHEMATICA 12.0 that he sent us earlier and he provided the information how we activate the software. After that he showed how to solve the numerical problems like addition, multiplication, subtraction and division using MAYHEMATICA. He constructed mathematical models on various Prey-Predator Model and their comparative solution using that software. The session was live and

participants shared their problems while using the software and he resolved the problems.

DAY 4 (13/01/2022)

Session I (10:30 to 12:00)

10. **Prof. S. Ponnusamy** of **Department of Mathematics, Indian Institute of Technology, Madras, Chennai,** simplified'**Foundations of Complex Analysis'**.

Professor Ponnusamy started his lecture on some important concepts of Complex Analysis. At the beginning, he introduced the notations and symbols used in the study of Complex Analysis. Then he explained the concept of Analytic functions with several examples. He discussed about boundedness of various types of Analytic functions. Then he explained Cauchy-Riemann Equation, Laplace Equation, Zero of Analytic functions and Entire Functions very carefully. At the end, he discussed about the Schwarz Lemma and Liouville's Theorem. During the lecture, professor Ponnusamy discussed several questions and their detailed solution to clear the concepts related to various important notion of Complex Analysis..

Session II (12:10 to 13:40)

11. **Prof. J. Patel** of**Department of Mathematics, Utkal University, Bhubaneswar,** elaborated **"Metric Spaces"**.

Professor Patel started his lecture by basic definition and examples of distance functions on a set and Metric Spaces. Then he discussed about convergence of sequences in a metric space, Cauchy Sequence and its properties and Completeness of a metric space. He gave detailed proofs of necessary theorems and also provided many examples related to each of these topics. Continuity of functions between two metric spaces in terms of open set and also in terms of convergence of sequences was discussed at the end of the lecture.

Session III (14:20 to 15:50) & Session IV (16:00 to 17:30)

12. **Prof. Badam Singh Kushvah**of **Department of Mathematics and Compting, Indian Institute of Technology, Dhanbad** discusses about'**Basics and Advanced Topics of Python'**

He shared the literature, and development of Python and also the different version of Python. He demonstrated the working process of Python by various arithmetic operations of different types of data and Data structures. Further, he showed the usage of library functions like math, cmathetc also the functional operations and their operationality with appropriate examples.

In continuation of the basics of Python, he introduced advanced operations in Python. He exhibited various operations on sequences, passing an argument to functions, copying the object, equality and Identity, introspection, magic names, Docstring, input-output arguments, printing options. Further, he showed how to open a file, read a file, write a file and also how to control the flow of the Python interpreter through various conditional operators IF-then-ELSE, FOR loop, While loop, etc. Also, the

usage of NUMPY library for numerical calculations, matplotlib library for plotting the graphs, visualizing matrix data.

DAY 5 (14/01/2022)

Session I (10:30 to 12:00)

13. **Prof. Bhaskar Mukherjee, Librarian**of **Department of Library and Information Science, Banaras Hindu University, Varanasi** expressed his views on thetopic'**Predatism in Scholarly communication process and Academic integrity**'.

He described different aspects of Plagiarism. He briefly explained ten criteria of identifying quality journals. After that he described DOAJ inclusion policy. He elaborated the citation measurement tools & journal Impact Factor with examples. He also nicely presented how one can understand quality of a journal on his own. He also told us about SJR (Scimago Journal & Country Rank). He also described how we can determine the Impact factor of any journal. He also explained H-index, G-index and i10-index of journals with examples. Finally, he shows that how we can carry out our research by overcoming these difficulties of plagiarism.

Session II (12:10 to 13:40)

14. **Dr.SahadeoPadhye** of **Department of Mathematics, MotilalNehru National Institute of Technology Allahabad, Prayagraj**evaluated **'Micro Teaching Activity-01'**.

The microteaching activity of this refresher course started in this session. Presentation details of the participants in this session are as below:

S.No.	Name of the Participant	Topic
2	Mr.SunilkumarKuwarlalShende	Ideal of Ring
3	JayprakashLaxmanMatlam	Simplex method
6	SurekhaDewangan	Fuzzy set theory
7	Dr. Sujoy Das	An introduction to metric spaces
8	RamprosadSaha	Trapezoidal rule's for Numerical Integration and write C-Programme
9	Lokesh Kumar Satpathi	Relation and function
10	Dr.Dipti Thakur	Signed Measure

Session III (14:20 to 15:50)

15. **Prof. GadadharMisra** of **Department of Mathematics, Banaras Hindu University, Varanasi,** threw light on thetopic'**Fundamental Theorem of Calculus, Green's Theorem and Poincare Lemma'**.

He started his lecture by explaining about the essentials of calculus and also he explains about the two forms of Fundamental Theorem of Calculus (Differential and Integral Forms) in detailed manner and also he explained about generalisation of Fundamental Theorem of Calculus to Multivariate Functions in which an integral can be evaluated using chain rule. Also Poincare lemma for star shaped domains were explained for several diagrams. He explained about Green's theorem and its necessary condition using Primitives and Gradient. Also Theorem on Sequence and connected sets were discussed. He clarified all the doubts raised by the participants.

Session IV (16:00 to 17:30)

16. **Dr. SahadeoPadhye** of **Department of Mathematics, MotilalNehru National Institute of Technology Allahabad, Prayagraj**evaluated **'Micro Teaching Activity-02'**.

This wassecond session on microteaching activity of this refresher course. Presentation details of the participants in this session are as below:

S.No.	Name of the Participant	Topic
11	Chandrauday Das Manikpuri	Equivalence Relation
12	Suganthi R.K.	Shortest path problem
13	Chetan Kumar Sahu	Group Theory
15	Kiran Dewangan	Logic gates
16	AniketAvinashMuley	Introduction to R
17	Dr.Govind Prasad Sahu	Introduction to Modern Probability
18	GnanavelSoundararajan	Metric space
19	Dr.S.P.R.Priyalatha	Topology
20	Dr.Samiran Banerjee	Sequence of functions
21	PratapMondal	Introduction to PDE
22	Dr.Debraj Chandra	Complexification of Real Vector Spaces
23	Dr.Dhrubajyoti Mandal	Quotient of a Vector Space

DAY 6 (15/01/2022)

Session I (10:30 to 12:00)

17. **Prof. K.N.Raghavan**of **The Institute of Mathematical Sciences, CIT Campus,**

Taramani, Chennai elucidated the topic'**Introductory talks on Topology-01** '.

At the beginning of the lecture, Prof.Raghavan gave a link(https://www.imsc.res.in/~knr/past/top15/index.html) for the reference of his Introductory talkson Topology. In the demonstrations, he explained topological space with examples. He alsodiscussed neighborhood on topological space and matric space. He also discussed continuity andcompactness on topological spaces. He solved some exercises on continuity. He also describedSubspace topology and product topology. His final point was to discuss the concept of Final and Initial topology.

Session II (12:10 to 13:40)

18. **Prof. J. Patel** of**Department of Mathematics, Utkal University, Bhubaneswar**elaborated "**Normed and Banach Spaces"**.

He discussed vector spaces with examples before moving to main topics. Following that, he described the normed space with examples. He compared normed linear and matric spaces during his lecture to make it more interesting. Afterward, he explored different norms for different spaces. Then he discussed linear transformation and linear functional on normed spaces and also illustrated their boundedness with examples. Defining continuity of linear transformations, he summarized some well known results on continuity. Later, he addressed bounded linear transformation spaces. Prof. Patel explained the Hahn-Banach theorem concept with examples and discussed that the theorem's extension is not unique. At the end of his lecture, Prof. Patel discussed some of the consequences of Hahn- Banach's theorem.

Session III (14:20 to 15:50)

19. **Prof. GadadharMisra** of **Department of Mathematics, Banaras Hindu University, Varanasi,**threw light on thetopic**'The Ahlfor's Schwarz Lemma'**.

Professor Misra started his lecture on 'The Ahlfor's Schwarz Lemma'. At the beginning, he stated 'Schwarz Lemma' and 'Maximum Modulus Principle', with detailed proof. Then he defined automorphism. After that he discussed about 'Automorphism Group of the Disc'. Then he introduced 'Riemanian Metric' followed by a detailed discussion about 'Gaussian Curvature'. At last, he presented the Ahlfor's version of the Schwarz Lemma with detailed proof.

Session IV (16:00 to 17:30)

20. **Dr. SahadeoPadhye** of **Department of Mathematics, MotilalNehru National Institute of Technology Allahabad, Prayagraj**evaluated **'Micro Teaching Activity-03'**.

This was last session on microteaching activity of this refresher course. Presentation details of the participants in this session are as below:

S.No.	Name of the Participant	Topic
24	Dr.S. Jayalakshmi	Sampling Methods
25	Dr.Brojeswar Pal	Sensitivity Analysis in Linear Programming
26	Dr.M. Vigneshwaran	Normed Linear Spaces
27	Dr.D. Vijayalakshmi	Basic Concepts in Graph Theory

28	Dr.Sudipta Dutta	Cosets, Lagrange's Theorem and its Applications
29	Muthuvel K	Open Set: Continuous Functions
30	Dildar Singh Tandon	Kernel of Homomorphism
31	Pooja Rai	Integral Equations
32	Dr.Faroz Ahmad Bhat	Sylow's Theorem on Finite Groups
33	Patel Aryan Kanjibhai	Quotient Ring
34	Sarifuddin	Fixed Point Iteration Method
35	MD MeezanurRahaman	Stable and Unstable Equilibrium

DAY 7 (17/01/2022)

Session I (10:30 to 12:00)

21. **Prof. A.K.Nandakumaran**of **Department of Mathematics, Indian Institute of Science, Bangalore** threw light on thetopic'**Partial Differential Equations-01** '.

At the beginning, Prof. Nandakumaran started discussing about the prerequisites for studying *PDE*. He briefly explained the notion of the *Laplace operator*. Prof. Nandakumaran then gave more general introduction to the concepts of *solvability of the Boundary value problems (BVP)*. He considered the *Laplace equation* and presented few interesting properties of the *Laplace operator*. He started investigating whether there is a *radial solution* of the *Laplace equation*. He then brought into the concepts of *fundamental solutions* and *local integrability* and explained them with examples, which are closely related to achieve the solution of the *Laplace equation*. Prof. Nandakumaran had performed critical analysis of every

terminology that he mentioned during the talk by linking the concepts from *Linear Algebra* to *Analysis* and *Multivariable Calculus* as well.

Session II (12:10 to 13:40)

22. **Prof. Malay Banerjee, Department of Mathematics&Statistics, Indian Institute of Technology, Kanpur**delivered the lecture on **"Introduction to compartmental models in epidemiology"**.

Prof. Banerjee concentrate on the models associated with the epidemic diseases for humans. He started talking on simple *mathematical models* which are used in *mathematical epidemiology*. He briefly discussed about the key facts that are required for construction of such *mathematical models*. Thengraduallyheenteredintothe construction of a *SIR model* (where the compartments are: *S-Susceptible, I-Infectious, R-Recovered*) by considering *ordinary differential equations*. He then explained how to estimate various *epidemiological parameters* such as *basic reproduction number*, *effective reproduction number* etc. for this model. Prof. Banerjee then considered the *SIRS model*, *SEIR model*, *Influenza model*, *SEQIJR model* and T*wo-Strain epidemic model (SIR)* to predict similar such findings done for the earlier models.

Session III (14:20 to 15:50)

23. **Prof. GadadharMisra** of **Department of Mathematics, Banaras Hindu University, Varanasi,**threw light on thetopic'**Differentiation'**.

This was Prof. Misra's third lecture in this Refresher Course. Last day, he delivered lecture on "Ahlfor's-Schwarz Lemma". In this session, Prof. Misra delivered the lecture on "Differentiation" which was some sort of continuation of previous lecture. Prof. Misra started discussion considering the space of all holomorphic functions on D which are square integrable with respect to the area measure. This space is a Hilbert space. He also introduced the mathematical objects namely, the Mobius Group, Algebra etc. He briefly explained the notion of the *Multiplier Representation* U and mentioned the relation between U and the multiplier identity. Prof. Misra then gave the idea how to construct multiplier taking values, say, n x n matrices. Then he established the rule for derivation of multiplier identity.

Session IV (16:00 to 17:30)

24. **Prof. D.R. Sahu** of **Department of Mathematics, Banaras Hindu University, Varanasi**evaluated **'Seminar Presentation-01'**.

This was first session on Seminar Presentation activity of this refresher course. During the presentation Prof.Sahu asked question from participants on their presentation topics. Presentation details of the participants in this session are as below:

S.No.	Name of the Participant	Topic
2	Mr.SunilkumarKuwarlalShende	Rank Nullity Theorem
3	JayprakashLaxmanMatlam	Vector Spaces
6	SurekhaDewangan	Mathematical Modelling by Using ODE

7	Dr. Sujoy Das	An Introduction to Multi Metric Space
8	Dr.RamprosadSaha	Role of Flow pulsatility and time dependent release kinetics on stent-based drug delivery from drug-eluting stent(DES) through atherosclerotic plaque in arterial tissue:A computational approach
9	Dr.Lokesh Kumar Satpathi	Ring Theory
10	Dr.Dipti Thakur	Introduction to CAT(0) Spaces
11	Chandrauday Das Manikpuri	Pell's Equation with integer solution
12	Suganthi R.K.	Numerical solution to Boundary layer problem
13	Chetan Kumar Sahu	Ramanujan: A man who knew infinity

DAY 8 (18/01/2022)

Session I (10:30 to 12:00)

25. **Prof. A.K.Nandakumaran**of **Department of Mathematics, Indian Institute of Science, Bangalore**threw light on thetopic'**Partial Differential Equations-02** '.

The speaker began the session by stating the importance of 'Benefit by doing exercises' and insisted the participants also to practice the same for the students. He delivered the importance and application of Laplacian operator in partial differential equations and made us to understand the other dimension of partial differential equations.

The speaker also explained Mean value theorem and its properties. He described the strong and weak maximum principles, the concept of Greens representation formula.

Session II (12:10 to 13:40)

26. **Prof. J. Patel** of **Department of Mathematics, Utkal University, Bhubaneswar**elaborated"**Banach Spaces, Dual Spaces, Uniform Bounded Principle"**.

The speaker began the session by defining Banach Space followed with many examples to have a depth understanding of the concept. He explained about equivalence norms and few theorems, examples on the same. He also introduced the concept of Schauder basis and how they differ from Hamel basis of a vector space. Thus, he defined Schauder basis, following which he defined isometry, isometrically isomorphism with examples.

He explained about pointwise boundedness and uniformly boundedness and raised a question of when a family of pointwise bounded set is uniformly bounded via which he introduced the uniform bounded principle as the answer. Finally, he concluded the session by presenting the weaker version of the uniform bounded principle 'BanachSteinhaus Theorem' with examples.

Session III (14:20 to 15:50) & Session IV (16:00 to 17:30)

27. **Dr. Sajeev Anand Sahu** of **Department of Mathematics and Computing, Indian Institute of Technology,Dhanbad,** evaluated '**Seminar Presentation 02 & 03'**.

This was second and third session on Seminar Presentation activity of this refresher course. The Participants presented on different topics of Mathematics in 10 Minutes duration. The details of presenters and their titles are tabulated below.

S. No.	Name of the Participant	Topic
15	Kiran Dewangan	Introduction of graph theory
16	AniketAvinashMuley	Particle Swarm optimization
17	Dr.Govind Prasad Sahu	Infinite sets
18	GnanavelSoundararajan	Partial Differential Equations-Weak derivatives
19	Dr.S.P.R.Priyalatha	Connectedness
20	Dr.Samiran Banerjee	On Graphs of Alternating Knots
21	PratapMondal	H-U-R stability of a pexider type quadratic functional equation in Banach spaces
22	Dr.Debraj Chandra	Certain types of selection principles and covering properties in topology
23	Dr.Dhrubajyoti Mandal	Controlling the dangerous effect of the stochastically vibrating border in piecewise smooth 1-D maps
24	Dr.S. Jayalakshmi	Statistical Quality control
25	Dr.Brojeswar Pal	Two cycle imperfect production inventory model
26	Dr.M. Vigneshwaran	Digital Topology
27	Dr.D. Vijayalakshmi	Graph coloring
28	Dr.Sudipta Dutta	AI-Statistical convergence
29	Muthuvel K	Fractional Derivative
30	Dildar Singh Tandon	A Product of fuzzy graph

DAY 9 (19/01/2022)

Session I (10:30 to 12:00)

28. **Prof. Malay Banerjee, Department of Mathematics &Statistics, Indian Institute of Technology, Kanpur**delivered the lectureon**"Mathematical exploration of compartmental epidemic models".**

Prof. Malay Banerjee started his lecture by asking participants for any difficulties in the previous lecture and participants raised no concern. Then he started the session with the basic reproduction and the basic reproduction number. He elaborately discussed about Largest positive eigen value, Equilibrium point, SIQR model, Two-strain model, Model with Treatment, Bifurcation model, Backward bifurcation model etc.Prof. Banerjee spoke deeply in all the areas of the subject and all the necessary differential equation within details derivation. All the properties of such equations also had been discussed deeply.

Session II (12:10 to 13:40)

29. **Dr. T. Suman Kumar** of**School of Mathematics and Statistics, University of Hyderabad**simplified the topic "**Linear parabolic and hyperbolic PDEs-01"**.

At the beginning Dr. T. Suman Kumar outlined the wave equation and discussed the difficulties involved in it. Then, he started lecturing from some basic preliminary concepts regarding partial differential equation. The he discussed integration by parts for multivariable used in the partial differential equations. Then he presented nicely the basic properties of Partial differential equations.Dr. T. Suman

Kumar elaborately discussed about Surface to volume integrals, Surface to repeated integral, Gauss divergence theorem, etc. He also discussed many things regarding this subject many theorem and its proof etc.

Session III (14:20 to 15:50) & Session IV (16:00 to 17:30)

30. **Prof. Birendra Kumar Sharma (Retired Professor)** of **School of Studies in Mathematics, Pt.Ravishankar Shukla University Raipur,** assessed Project presentation of the participants.

The list of participants along with their group and presented topics are listed below:

S. No.	Name of the Participant	Group	Title of Project
3	JayprakashLaxmanMatlam	1	Higher order Taylor Methods
6	SurekhaDewangan		
8	RamprosadSaha		
7	Dr. Sujoy Das	2	Soft Real Numbers and their applications
9	Lokesh Kumar Satpathi		
10	Dr.Dipti Thakur		
11	Chandrauday Das Manikpuri	3	Mesh free method in the study of heat and mass transfer analysis in a free convective doubly stratified medium
12	Suganthi R.K.		
13	Chetan Kumar Sahu		
2	Mr.SunilkumarKuwarlalShende		
15	Kiran Dewangan	4	Mathematical Modeling Optimization approach to study Air pollution parameters in Raipur
16	AniketAvinashMuley		
17	Dr.Govind Prasad Sahu		
18	GnanavelSoundararajan	5	Parameter Identification Problems in the System of Partial Differential Equations via Optimal Control Problem
19	Dr.S.P.R.Priyalatha		
20	Dr.Samiran Banerjee		
21	PratapMondal	6	Comparative study on Hyers –Ulam-Rassias stability of pexider type functional equations in Banach spaces using direct
22	Dr.Debraj Chandra		

23	Dr.Dhrubajyoti Mandal		method and fixed point method
24	Dr.S. Jayalakshmi	7	b*gα-closed and b*gα -open sets in the digital plane
25	Dr.Brojeswar Pal		
26	Dr.M. Vigneshwaran		
27	Dr.D. Vijayalakshmi	8	An Approach of Graph B-Colouring in Topological Indices and Its Chemical Applications
28	Dr.Sudipta Dutta		
29	Muthuvel K		
30	Dildar Singh Tandon	9	Coagulation Models.
31	Pooja Rai		
35	MD MeezanurRahaman		
32	Dr.Faroz Ahmad Bhat	10	Mathematical Modeling of non-Newtonian Blood Flow in Stenotic Artery
33	Patel Aryan Kanjibhai		
34	Sarifuddin		

DAY 10 (20/01/2022)

Session I (10:30 to 12:00)

31. **Prof. Malay Banerjee, Department of Mathematics &Statitstics, Indian Institute of Technology, Kanpur**delivered the lecture on "**Delayed models in epidemiology".**

Prof. Malay Banerjee started his lecture on Delayed models in epidemiology. He described different types of delayed model equations on epidemiology. He briefly explained about epidemiology. After that he described delayed SIR model, temporary immunity and SEIR model. He elaborately discussed about stability analysis of above said delayed model equations with examples. Finally, he shows that how we can investigate patterns and causes of disease and injury and how to

reduce the risk and occurrence of negative health outcomes through research, community education and health policy.

Session II (12:10 to 13:40)

32. **Dr. T. Suman Kumar**from**School of Mathematics and Statistics, University of Hyderabad**simplified the topic"**Linear parabolic and hyperbolic PDEs-02"**.

This was second lecture of Dr.Suman Kumar in this Refresher Course.At the beginning he outlined the Second-Order Partial Differential Equations and classification of Second-Order Partial Differential Equations. He briefly explained about Linear, Semi linear, and Nonlinear Second-Order PDEs with example.

Dr. T. Suman Kumar elaborately discussed about Heat equation, Wave equation and Laplace equations with their examples. He also discussed about the equation of vibration of a string with their method of solution, etc.

Session III (14:20 to 15:50)

33. **Prof. SudhirRamakantGhorpade**from**Department of Mathematics, Indian Institute of Technology, Bombay, Powai, Mumbai,** put in the words'**History of Algebra**'.

The resource person Professor S. Ghorpade at the outset introduced the very common concept of quadratic equation and announced the very origin of the quadratic equation. He then gave interesting general technique of solving a quadratic equation by purely involving the

fundamental operations of arithmetic with extraction of square root inclusive. He then discussed the application of quadratic equation with the help of an example. Moving to ahead in the lecture the resource person have enlightened participants by deriving the solution of a general cubic equation in which he first removed the 2nd term of the equation using the technique of diminishing the roots of the equation by a constant equal to the ratio of sum of roots of the equation by the degree of equation. He also mentioned the origin of solution of biquadratic equation to the audience. Finally, he showed certain glimpses of non-solvability of equations of degree greater or equal to 5 by radicals after comparing them to the non-solvability of groups.

Session IV (16:00 to 17:30)

34. **Dr. SajeevAnandSahu** of **Department of Mathematics and Computing, Indian Institute of Technology,Dhanbad,** evaluated '**Seminar Presentation 04'**.

This was the last session on Seminar Presentation activity of this refresher course. The Participants presented on different topics of Mathematics in 10 Minutes duration. The details of presenters and their titles are tabulated below.

S. No.	Name of the Participant	Topic
31	Pooja Rai	Singularity
32	Dr.Faroz Ahmad Bhat	Complex versions of Rolle's theorem
33	Patel Aryan Kanjibhai	Topological spaces
34	Sarifuddin	Effect of Tissue Compositions on Drug Delivery after Drug-Coated Balloon Angioplasty : A Numerical Study
35	MD MeezanurRahaman	Mathematics in nature

DAY 11 (21/01/2022)

Session I (10:30 to 12:00)

35. **Prof. Malay Banerjee, Department of Mathematics &Statitstics, Indian Institute of Technology, Kanpur**delivered the lecture on "**Mathematical modelling of COVID-19 epidemic".**

This lecture was his last lecture in the series of four lectures in the refresher course.He started the lecture on Mathematical modelling of the COVID-19 epidemic. He gave an introduction about the coronavirus, COVID-19, SARS-CoV-2, etc., then he discussed data on the distribution of infected COVID-19across the globe country-wise. In particular, he compared the infected report of the UK, Germany, France and Russia in graphs and also analysed the first, second and third wave of the above countries. He mentioned the various modelling approaches like delay differential equation model, age-structured model, etc., of the COVID-19 epidemic. The combination of the above models was generally the Ordinary differential equation model. It involves different types of models like SIR, SEIR, SLIAR, SEIQR, SEIQHR models. He also mentioned the most straightforward model with Quarantine and their solution and analysed it with the various countries' COVID data. He also explained the extended SEIQR type model for the COVID-19 epidemic and analysed different country data graphically. He also described the vaccination in two group epidemic models in the equation and studied graphically. He analysed the model by fitting it with data of European countries, mainly

Germany, Italy, Spain,UK.Finally, he mentioned the equation of the immune-epidemiological model and analysed the data in graphical.

Session II (12:10 to 13:40)

36. **Dr. T. Suman Kumar** from **School of Mathematics and Statistics, University of Hyderabad**simplified the topic "**Linear parabolic and hyperbolic PDEs-03"**.

He first discussed some of the resultsof solution hyperbolic equations, which were completed in his last lectureand explained the surface integral, and then he described the method of descent for the wave equation solution in 2D. He derived the D'Alembert, Kirchhoff and Poisson formula and also derived the observation of the above procedures. Also, he discussed sound wave propagation in 3D.

He also talked about Huygens principles and wave equation. He discussed the heat equation and Fourier transform, Riemann integral, Dirichlet, Jorden results. Hediscussed the historical background of construction and solution of heat equation by Fourier.Lastly, he discussed some fundamental results for the solution of the heat equation.

Session III (14:20 to 15:50)

37. **Dr. Suparna Sen Gupta, Librarian**of **Pt.Sundar Lal Sharma Library, Pt. Ravishankar Shukla University, Raipur,**threw light on the topics'**Author identifier & its Role in Academia**', '**IPR & Copyright' and 'Do's** and **don'ts for Publication in Quality Journals'**.

He talked about along with Eigen Vector. Then he explained extensively about matrix, linear transformation, matrix representation

Session IV (16:00 to 17:30)

38. **Prof. Bhaskar Mukherjee,** from**Department of Library and Information Science, Banaras Hindu University, Varanasi**expressed his views on thetopic'**Plagiarism and Ethical Practices in Teaching and Research**'.

resources for study. He explained the advantages of accessing the e-resources. He meticulously

DAY 12 (22/01/2022)

Session I (10:30 to 12:00)

39. **Prof. K.N.Raghavan**of **The Institute of Mathematical Sciences, CIT Campus, Taramani, Chennai**elucidated the topic'**Euler's Theorem and Applications** '.

This was second lecture of Prof. K.N.Raghavan in this Refresher Course. In this lecture, he started with introduction of mathematician Paul Erdos and his contribution in mathematics. He gave information regarding book "Proof from the Book" written by Paul Erdos. Lecture of the session was from chapter-12 of this

book. He discussed about planner graph, Euler's theorem on planner graph. He explained about spanning tree and related theorems. He meticulously explained Euler's characteristics with examples.

Session II (12:10 to 13:40)

40. **Dr. T. Suman Kumar** of**School of Mathematics and Statistics, University of Hyderabad**simplified the topic "**Linear parabolic and hyperbolic PDEs-04"**.

It was fourth and last lecture by Dr.Suman Kumar in the series of Linear Parabolic and Hyperbolic Partial Differential Equations. He discussed about solution of Heat equation. He derived expression for solution of initial value problems. He discussed about fundamental solutions and its derivation. He stated and prove the mean value properties. Further, he discussed about strong and weak maximum principles. He also explained uniqueness of the solution by Energy method.

Session III (14:20 to 15:50)

41. **Prof. Rajendra Prasad Das, Pro-Vice Chancellor of** Indira **Gandhi National Open University, New Delhi,** spoke on thetopic titled'**Pedagogy in Education**'.

This was last lecture in this Refresher Course. Prof. Das explained different teaching pedagogies. He stressed on the phobia for mathematics for many students and focused on active teaching to make the subject interesting from the student's point of view. He discussed about *case method* of teaching with an example.He emphasized on the method of active teaching that enhances critical thinking, communication and group discussion among students as compare to passive teaching of lecture type. He also discussed about

New Education Policy 2020 and its importance from the mathematics subject point of view.

Session IV (16:00 to 17:30)Valedictory Function

Prof K L Verma, Hon'ble Vice-Chancellor of Pt. Ravishankar Shukla University, Raipur, was the **Chief Guest** in this function.**Prof ShailendraSaraf,** Director, HRDC, Pt. Ravishankar Shukla University, Raipur, was the **Chairperson. Prof Balwant Singh Thakur,** Head, School of Studies in Mathematics, Pt. Ravishankar Shukla University, Raipur, was present as **Course Coordinator**.

Course coordinator, Prof Balwant Singh Thakur, presented brief report of this refresher course and make announcement for availability of recorded lectures of this refresher course in the website. Thereafter, opportunity was given to the participants for providing their feedback,they all appreciated the overall organization, contents, selection of resource persons from premier institutions and execution of the refresher course.Chairperson, Professor ShailendraSarafaddressed the function, he assured that HRDC will continue to organize such good refresher courses. He congratulated Professor Balwant Singh Thakur, for successful conduction of refresher course.Honorable VC Prof. K. L. Verma, blessed all the participants with his valuable words and congratulated all the participants successfully completing the refresher course and gave best wishes implementing and sharing the knowledge learnt in the refresher course.

In the last, Dr. Arvind Agrawal, Assistant Professor, HRDC was given vote of thanks to the guests, participants and everyone involved in this refresher course.

UGC Human Resource Development Centre
Pt. Ravishankar Shukla University, Raipur-492010
(Chhattisgarh

Refresher Course in Mathematics

(10/01/2022 to 22/01/ 2022)

Time Table

	Session -I (10:30 to 12:00)		Session -II (12:10 to 13:40)		Session -III (14:20 to 15:50)		Session -IV (16:00 to 17:30)
First Week							
Day 01 10/01/2022	Registration, Inauguration & Induction	TEA Break	Lecture-01 Prof. S. Ghorpade	LUNCH Break	Lecture-02 Prof.Kalyan Chakraborty	TEA Break	Lecture-03 Prof.Kalyan Chakraborty
Day 02 11/01/2022	Lecture-04 Dr.SuparnaSengupta		Lecture-05 Prof. S. Ghorpade		Lecture-06 Prof.D.R.Sahu		Lecture-07 Dr. Rakesh Jana
Day 03 12/01/2022	Lecture-08 Prof.D.R.Sahu		Lecture-09 Dr. Rakesh Jana		Lecture-10 Prof.Sandip Banerjee		Lecture-11 Prof.Sandip Banerjee
Day 04 13/01/2022	Lecture-12 Prof. S. Ponnusamy		Lecture-13 Prof.Jagannath Patel		Lecture-14 Prof. B. S. Kushvah		Lecture-15 Prof. B. S. Kushvah
Day 05 14/01/2022	Lecture-16 Prof.Bhaskar Mukherjee		ICT/Micro teaching-01 Dr.SahadeoPadhye		Lecture-17 Prof.GadadharMisra		ICT/Micro teaching-02 Dr.SahadeoPadhye
Day 06 15/01/2022	Lecture-18 Prof.K.N.Raghavan		Lecture-19 Prof.Jagannath Patel		Lecture-20 Prof.GadadharMisra		ICT/Micro teaching-03 Dr.SahadeoPadhye
Second Week							
Day 07 17/01/2022	Lecture-21 Prof.A.K.Nandkumaran	TEA Break	Lecture-22 Prof. Malay Banerjee	LUNCH Break	Lecture-23 Prof.GadadharMisra	TEA Break	Seminar Presentation-01 Prof.D.R.Sahu
Day 08 18/01/2022	Lecture-24 Prof.A.K.Nandkumaran		Lecture-25 Prof.Jagannath Patel		Seminar Presentation-02 Dr. Sanjeev AnandSahu		Seminar Presentation-03 Dr. Sanjeev AnandSahu
Day 09 19/01/2022	Lecture-26 Prof. Malay Banerjee		Lecture-27 Dr.T.Suman Kumar		Project Presentation-01 Prof.B.K.Sharma		Project Presentation-02 Prof.B.K.Sharma
Day 10 20/01/2022	Lecture-28 Prof. Malay Banerjee		Lecture-29 Dr.T.Suman Kumar		Lecture-30 Prof. S. Ghorpade		Seminar Presentation-04 Dr. Sanjeev AnandSahu
							MCQ End Test
Day 11 21/01/2022	Lecture-31 Prof. Malay Banerjee		Lecture-32 Dr.T.Suman Kumar		Lecture-33 Dr.SuparnaSengupta		Lecture-34 Prof.Bhaskar Mukherjee
Day 12 22/01/2022	Lecture-35 Prof.K.N.Raghavan		Lecture-36 Dr.T.Suman Kumar		Lecture-37 Prof. R.P. Das		Valedictory & Concluding Session

Course Coordinator:
Prof. B.S. Thakur, SoS in Mathematics, PRSU, Raipur
E-mail:balwantst@gmail.com

Daily Activity Schedule

Date: 10/01/2022, Monday
Day: 01
Week: First Week

Schedule

Session-I 10:30 -12:00	Registration, Inauguration & Induction
12:00 -12:10	Break
Session-II 12:10 -13:40	Lecture-01: Spectral Theorems for Matrices-01 Prof. S.R.Ghorpade Department of Mathematics Indian Institute of Technology, Bombay Powai, Mumbai 400076, India E-mail: srg@math.iitb.ac.in
13:40 -14:20	Break
Session-III 14:20 -15:50	Lecture-02: Introduction to the 'Theory of Numbers'-01 Prof. Kalyan Chakraborty Director KSCSTE-Kerala School of Mathematics Kozhikode, Kerala E-mail: kalychak@ksom.res.in
15:50 -16:00	Break
Session-IV 16:00 -17:30	Lecture-03: Introduction to the 'Theory of Numbers'-02 Prof. Kalyan Chakraborty Director KSCSTE-Kerala School of Mathematics Kozhikode, Kerala E-mail: kalychak@ksom.res.in

Session	Chairperson	Reporter
I & II	Dr. Govind Prasad Sahu	Dr. Samiran Banerjee
III & IV	Sarifuddin	MD MeezanurRahaman

Date: 11/01/2022, Tuesday

Day: 02

Week: First Week

Schedule	
Session-I 10:30 -12:00	Lecture-04: E-Resources Dr. SuparnaSengupta Librarian, Pt.Sundar Lal Sharma Library Pt. Ravishankar Shukla University, Raipur E-mail: suparnasengupta61@gmail.com
12:00 -12:10	Break
Session-II 12:10 -13:40	Lecture-05: Spectral Theorems for Matrices-02 Prof. S.R.Ghorpade Department of Mathematics Indian Institute of Technology, Bombay, Mumbai, India E-mail: srg@math.iitb.ac.in
13:40 -14:20	Break
Session-III 14:20 -15:50	Lecture-06:Optimization via fixed point theory-01 Prof. D.R.Sahu Department of Mathematics Banaras Hindu University, Varanasi E-mail: drsahudr@gmail.com
15:50 -16:00	Break
Session-IV 16:00 -17:30	Lecture-07:LaTeX: Basics, Mathematics, and Table Dr. Rakesh Jana Department of Mathematics Indian Institute of Technology, Guwahati E-mail: j.rakesh@iitg.ac.in

Session	Chairperson	Reporter
I & II	Dr. Samiran Banerjee	Dr. Samiran Banerjee
III & IV	Mr. SunilkumarKuwarlalShende	Dr. S. Jayalakshmi

Date: 12/01/2022, Wednesday

Day: 03

Week: First Week

Schedule	
Session-I **10:30 -12:00**	**Lecture-08:Optimization via fixed point theory-02** **Prof. D.R.Sahu** Department of Mathematics Banaras Hindu University, Varanasi **E-mail: drsahudr@gmail.com**
12:00 -12:10	**Break**
Session-II **12:10 -13:40**	**Lecture-09:LaTeX: Figure, References and Citations, Tikz** **Dr. Rakesh Jana** Department of Mathematics Indian Institute of Technology, Guwahati **E-mail: j.rakesh@iitg.ac.in**
13:40 -14:20	**Break**
Session-III **14:20 -15:50**	**Lecture-10:Mathematical Modeling with MATHEMATICA-01** **Prof. Sandip Banerjee** Department of Mathematics Indian Institute of Technology, Roorkee **E-mail: sandip.banerjee@ma.iitr.ac.in**
15:50 -16:00	**Break**
Session-IV **16:00 -17:30**	**Lecture-11:Mathematical Modeling with MATHEMATICA-02** **Prof. Sandip Banerjee** Department of Mathematics Indian Institute of Technology, Roorkee **E-mail: sandip.banerjee@ma.iitr.ac.in**

Session	Chairperson	Reporter
I & II	JayprakashLaxmanMatlam	Dr. S.P.R. Priyalatha
III & IV	Chandrauday Das Manikpuri	PratapMondal

Date: 13/01/2022, Thursday

Day: 04

Week: First Week

Schedule	
Session-I 10:30 -12:00	Lecture-12: Foundations of Complex Analysis Prof. S. Ponnusamy Department of Mathematics Indian Institute of Technology, Madras, Chennai, India E-mail: samy@iitm.ac.in
12:00 -12:10	Break
Session-II 12:10 -13:40	Lecture-13: Metric Spaces Prof. Jagannath Patel Professor (Retd.) Department of Mathematics Utkal University, Bhubaneswar E-mail: jpatelmath@yahoo.co.in
13:40 -14:20	Break
Session-III 14:20 -15:50	Lecture-14:Basics of Python Prof. B. S. Kushvah Department of Mathematics and Computing Indian Institute of Technology, Dhanbad E-mail: bskush@iitism.ac.in
15:50 -16:00	Break
Session-IV 16:00 -17:30	Lecture-15: Advanced Topics of Python Prof. B. S. Kushvah Department of Mathematics and Computing Indian Institute of Technology, Dhanbad E-mail: bskush@iitism.ac.in

Session	Chairperson	Reporter
I & II	Dr. Dhrubajyoti Mandal	M.S. Srinivasan
III & IV	SurekhaDewangan	GnanavelSoundararajan

Date: 14/01/2022, Friday

Day: 05

Week: First Week

Schedule	
Session-I 10:30 -12:00	Lecture-16:Plagiarism Prof. Bhaskar Mukherjee Department of Library & Information Science Banaras Hindu University, Varanasi E-mail: mukherjee.bhaskar@gmail.com
12:00 -12:10	Break
Session-II 12:10 -13:40	Micro Teaching -01 Dr. SahadeoPadhye Department of Mathematics Mohtilal Nehru National Institute of Technology Allahabad, Prayagraj **E-mail: sahadeo@mnnit.ac.in**
13:40 -14:20	Break
Session-III 14:20 -15:50	Lecture-17:Fundamental theorem of calculus, Green's theorem and the Poincare Lemma Prof. GadadharMisra J C Bose National Fellow Statistics and Mathematics Unit Indian Statistical Institute, Bangalore **E-mail:gadadhar.misra@gmail.com**
15:50 -16:00	Break
Session-IV 16:00 -17:30	Micro Teaching -02 Dr. SahadeoPadhye Department of Mathematics Mohtilal Nehru National Institute of Technology Allahabad, Prayagraj **E-mail: sahadeo@mnnit.ac.in**

Session	Chairperson	Reporter
I & II	RamprosadSaha	Dr. Sujoy Das
III & IV	Dr. Dipti Thakur	Dr. D. Vijayalakshmi

Date: 15/01/2022, Saturday

Day: 06

Week: First Week

Schedule	
Session-I 10:30 -12:00	Lecture-18:Introductory talks on Topology-01 Prof. K.N.Raghavan The Institute of Mathematical Sciences CIT Campus, Taramani, Chennai 600 113 E-mail: **knr@imsc.res.in**
12:00 -12:10	Break
Session-II 12:10 -13:40	Lecture-19:Normed and Banach Spaces Prof. Jagannath Patel Department of Mathematics Utkal University, Bhubaneswar **E-mail: jpatelmath@yahoo.co.in**
13:40 -14:20	Break
Session-III 14:20 -15:50	Lecture-20:The Ahlfor's Schwarz Lemma Prof. GadadharMisra J C Bose National Fellow Statistics and Mathematics Unit, Indian Statistical Institute, Bangalore **E-mail:gadadhar.misra@gmail.com**
15:50 -16:00	Break
Session-IV 16:00 -17:30	Micro Teaching -03 Dr. SahadeoPadhye Department of Mathematics Mohtilal Nehru National Institute of Technology Allahabad, Prayagraj **E-mail: sahadeo@mnnit.ac.in**

Session	Chairperson	Reporter
I & II	Dr. S.P.R. Priyalatha	Dr. Brojeswar Pal
III & IV	Lokesh Kumar Satpathi	Dr. Dhrubajyoti Mandal

Date: 17/01/2022, Monday

Day: 07

Week: Second Week

Schedule	
Session-I 10:30 -12:00	Lecture-21:Partial differential equations-01 Prof. A. K. Nandakumaran Department of Mathematics Indian Institute of Science Bangalore E-mail: nands@iisc.ac.in
12:00 -12:10	Break
Session-II 12:10 -13:40	Lecture-22:Introduction to compartmental models in epidemiology Prof. Malay Banerjee Department of Mathematics & Statistics Indian Institute of Technology, Kanpur E-mail: malayb@iitk.ac.in
13:40 -14:20	Break
Session-III 14:20 -15:50	Lecture-23:The determinant function Prof. GadadharMisra J C Bose National Fellow Statistics and Mathematics Unit Indian Statistical Institute, Bangalore E-mail:gadadhar.misra@gmail.com
15:50 -16:00	Break
Session-IV 16:00 -17:30	Seminar Presentation-01 Prof. D.R.Sahu Department of Mathematics Banaras Hindu University, Varanasi E-mail: drsahudr@gmail.com

Session	Chairperson	Reporter
I & II	Dr. Faroz Ahmad Bhat	Debraj Chandra
III & IV	Pooja Rai	Dr. Sudipta Dutta

Date: 18/01/2022, Tuesday

Day: 08

Week: Second Week

Schedule	
Session-I **10:30 -12:00**	**Lecture-24:** Partial differential equations-02 Prof. A. K. Nandakumaran Department of Mathematics Indian Institute of Science Bangalore **E-mail: nands@iisc.ac.in**
12:00 -12:10	Break
Session-II **12:10 -13:40**	**Lecture-25:** Banach Spaces, Dual Spaces, Uniform Bounded Principle Prof. Jagannath Patel Department of Mathematics Utkal University, Bhubaneswar **E-mail: jpatelmath@yahoo.co.in**
13:40 -14:20	Break
Session-III **14:20 -15:50**	Seminar Presentation-02 Dr. Sanjeev AnandSahu Department of Mathematics and Computing Indian Institute of Technology, Dhanbad **E-mail:sanjeev@iitism.ac.in**
15:50 -16:00	Break
Session-IV **16:00 -17:30**	Seminar Presentation-03 Dr. Sanjeev AnandSahu Department of Mathematics and Computing Indian Institute of Technology, Dhanbad **E-mail:sanjeev@iitism.ac.in**

Session	Chairperson	Reporter
I & II	Dr. S. Jayalakshmi	Suganthi R. K.
III & IV	Patel Aryan Kanjibhai	Dr. M. Vigneshwaran

Date: 19/01/2022, Wednesday

Day: 09

Week: Second Week

Schedule	
Session-I **10:30 -12:00**	**Lecture-26:** Mathematical exploration of compartmental epidemic models **Prof. Malay Banerjee** Department of Mathematics & Statistics Indian Institute of Technology, Kanpur **E-mail: malayb@iitk.ac.in**
12:00 -12:10	**Break**
Session-II **12:10 -13:40**	**Lecture-27:** Linear parabolic and hyperbolic PDEs-01 **Dr. T. Suman Kumar** School of Mathematics and Statistics University of Hyderabad **E-mail: suman.hcu@gmail.com**
13:40 -14:20	**Break**
Session-III **14:20 -15:50**	**Project Presentation-01** **Prof. B.K.Sharma** School of Studies in Mathematics, Pt.Ravishankar Shukla University, Raipur **E-mail: sharmabk07@gmail.com**
15:50 -16:00	**Break**
Session-IV **16:00 -17:30**	**Project Presentation-02** **Prof. B.K.Sharma** School of Studies in Mathematics, Pt.Ravishankar Shukla University, Raipur **E-mail: sharmabk07@gmail.com**

Session	Chairperson	Reporter
I & II	Dr. Sudipta Dutta	Sarifuddin
III & IV	Chetan Kumar Sahu	AniketAvinashMuley

Date: 20/01/2022, Thursday
Day: 10
Week: Second Week

Schedule	
Session-I 10:30 -12:00	Lecture-28:Delayed models in epidemiology Prof. Malay Banerjee Department of Mathematics & Statistics Indian Institute of Technology, Kanpur E-mail: malayb@iitk.ac.in
12:00 -12:10	Break
Session-II 12:10 -13:40	Lecture-29:Linear parabolic and hyperbolic PDEs -02 Dr. T. Suman Kumar School of Mathematics and Statistics University of Hyderabad E-mail: suman.hcu@gmail.com
13:40 -14:20	Break
Session-III 14:20 -15:50	Lecture-30:History of Algebra Prof. S.R.Ghorpade Department of Mathematics Indian Institute of Technology, Bombay Powai, Mumbai 400076, India E-mail: srg@math.iitb.ac.in
15:50 -16:00	Break
Session-IV 16:00 -17:30	Seminar Presentation-04 Dr. Sanjeev AnandSahu Department of Mathematics and Computing Indian Institute of Technology, Dhanbad E-mail:sanjeev@iitism.ac.in & MCQ End Term Test

Session	Chairperson	Reporter
I & II	Dr. Sujoy Das	RamprosadSaha
III & IV	Dr. D. Vijayalakshmi	Dr. Faroz Ahmad Bhat

Date: 21/01/2022, Friday

Day: 11

Week: Second Week

Schedule	
Session-I **10:30 -12:00**	**Lecture-31:Mathematical modelling of COVID-19 epidemic** **Prof. Malay Banerjee** Department of Mathematics & Statistics Indian Institute of Technology, Kanpur **E-mail: malayb@iitk.ac.in**
12:00 -12:10	**Break**
Session-II **12:10 -13:40**	**Lecture-32:Linear parabolic and hyperbolic PDEs -03** **Dr. T. Suman Kumar** School of Mathematics and Statistics University of Hyderabad **E-mail: suman.hcu@gmail.com**
13:40 -14:20	**Break**
Session-III **14:20 -15:50**	**Lecture-33:Author Identifier and it's metrics** **Dr. SuparnaSengupta** Librarian Pt.Sundar Lal Sharma Library Pt. Ravishankar Shukla University, Raipur **E-mail: suparnasengupta61@gmail.com**
15:50 -16:00	**Break**
Session-IV **16:00 -17:30**	**Lecture-34:Predatory Journals** **Prof. Bhaskar Mukherjee** Department of Library & Information Science Banaras Hindu University, Varanasi **E-mail: mukherjee.bhaskar@gmail.com**

Session	Chairperson	Reporter
I & II	Dr. Brojeswar Pal	Muthuvel K
III & IV	Dildar Singh Tandon	Pooja Rai

Date: 22/01/2022, Saturday

Day: 12

Week: Second Week

Schedule	
Session-I 10:30 -12:00	Lecture-35:Euler's Theorem and Applications Prof. K.N.Raghavan The Institute of Mathematical Sciences CIT Campus, Taramani, Chennai 600 113 E-mail: knr@imsc.res.in
12:00 -12:10	Break
Session-II 12:10 -13:40	Lecture-36:Linear parabolic and hyperbolic PDEs -04 Dr. T. Suman Kumar School of Mathematics and Statistics University of Hyderabad E-mail: suman.hcu@gmail.com
13:40 -14:20	Break
Session-III 14:20 -15:50	Lecture-37:Pedagogy in Education Prof. R.P. Das Pro-Vice Chancellor Indira Gandhi National Open University MaidanGarhi, New Delhi E-mail: dasrp29@gmail.com
15:50 -16:00	Break
Session-IV 16:00 -17:30	Valedictory & Concluding Session

Session	Chairperson	Reporter
I & II	GnanavelSoundararajan	Dr. Govind Prasad Sahu
III & IV	Kiran Dewangan	GnanavelSoundararajan

List of Participants

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Assessment Criterion and Marking:

Multiple-choice objective tests:	30
Seminars / participant presentation:	15
Project / survey / others:	20
Micro-teaching / participation:	10
Holistic response:	25
Total:	100

Grading pattern (based on Marks)

A+ : 85 percent and above

A : 70 percent to less than or equal to 84 percent

B : 60 percent to less than or equal to 69 percent

C : 50 percent to less than or equal to 59 percent

F : Below 49 percent

Those teacher participants who score F grade are required to repeat the program after a gap of one year without financial commitment to UGC-HRDC.

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