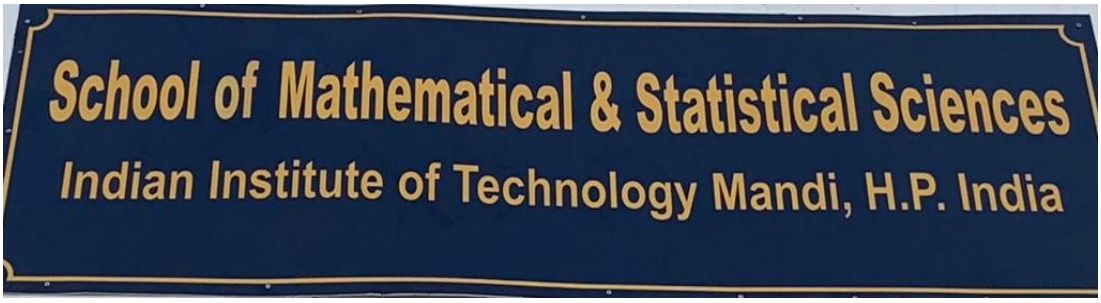
COMPILED REPORT

Name of Programme: CDP of PGTs (Mathematics)
Group Coordinator: Amit Kumar, Assisstant professor,SCERT
Administrative support :Dr. Surender Singh, Assisstant professor,DIET, RN
Duration : 25/02/2023 to 03/03/2023
Number of Participants: 48

Faculty Development Programe(FDP) in Mathematics for PGT Mathematics at IIT Mandi (HP) 25th February -3rd March 2023

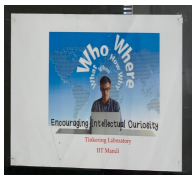


Report Day 0 ~ @25 th Feb 2023

Visit to tinkering lab of school of mathematics and statistical sciences IIT Mandi,HP ,India

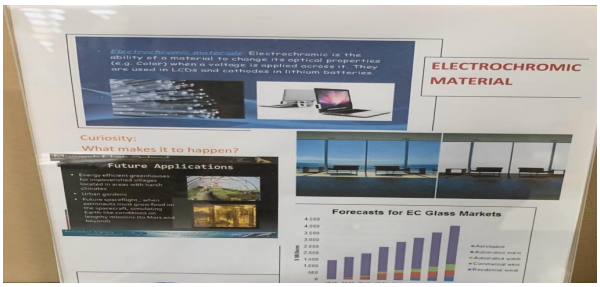
A group of 47 lecturers Mathematics from Directorate of Education, NCT of Delhi visited the tinkering laboratory of school of mathematical and statistical sciences, Indian Institute of technology, Mandi, Himachal Pradesh, India which was organised by SCERT Delhi and hosted by Mr Vineet a student

of IIT Mandi. The tinkering laboratory IIT Mandi is said to be a place to foster and encourage intellectual curiosity.



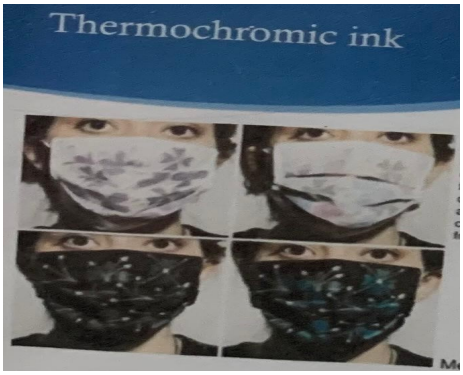
- The first experiment in the lab was about communication technologies which explain the involvement of the communication methods from contemporary method of two paper cups tied with a chord with the optical fiver to Wi-Fi and then life I the latest technology in the communication world. The difference between Wi-Fi and life I was well explained by Mr Vineet, as in Wi-Fi radio waves, transmit data at 1.25 MB. Where is LED light bulbs, transmit data at 1 GB/s .

Then we saw electro chromic material is the ability of a material to change its optical properties. Colour when current is passed through it this electro chromic material can be used for energy, efficient, greenhouses, auburn Gardens and future spaceflight when astronauts must grow food on the spacecraft, simulating earth like conditions on land, the missions that is to Mars and beyond



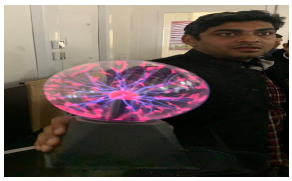
- Experiment three was photochromic material which change the colour when light is passed through it. We also saw photochromic pigment which is used to formulate UV screens, photographs, epoxy et cetera

- Experiment four was thermochromic ink that change colour with temperature because of the ability of the substance to convert thermal radiation into a chromic effect does changing the viewed colour. This thermochromic in was used as a form of visual communication by creating face mask during pandemic that picks up prices in the breed temperature to warn people to be cautious.



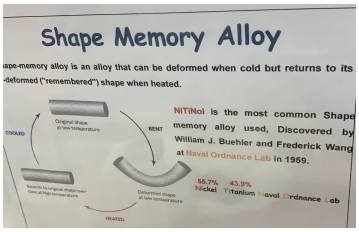
- Experiment four was Tesla coil invented by Nikola Tesla 1891. In this Tesla coil, step up transformer cost voltage of current down and high frequency at Resonance high voltage. Causes ionisation and energised. Excited electron emitted radiation whose wavelength is in visible region that is light based on this principle plasma ball was created in which Tesla coil at the centre produces. High-voltage waves that energised electron of various Inert gases like ARXEKR etc, stored inside ball and when they come back to ground state, I am at out lights of various colours in the

visible region. When we touch at periphery of spares circuit completed and a spark seems to be appeared in the electrified medium called plasma.

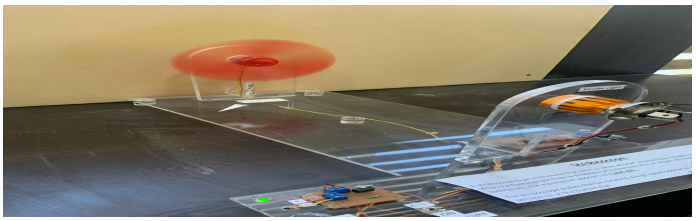


- Experiment five was an aerogel. Aerogel is a substance with extremely low thermal conductive. 80 demonstrated as Cadbury silk chocolate sit directly on the strong flame without melting for good half an hour five .

- Experiment six was shape memory alloy, which is an alloy that can be that can be formed when cold but returns to its deformed shape. When heated. This alloy is made up of nickel and titanium. Hence called Nitin all Nitin all can be used in medical sciences and dentistry.

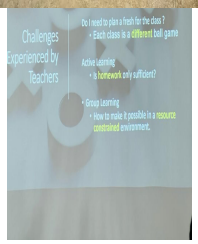


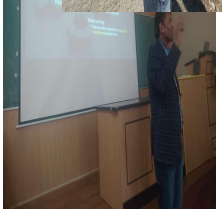
- Experiment seven was a stroboscope, which is an instrument that emits series of brief, intense flashing light at specific intervals, when the flashing light from a stroboscope is directed onto an object, rotating at high speed example, a cooling fan, the moving fan appears to standstill due to the visual persistence of the human eye



- There were many more experiments demonstrated by Mr Vineet to the team and we gain tremendous knowledge of many new concepts and their uses in daily life.

In the second half all the participants visited Prashar lake





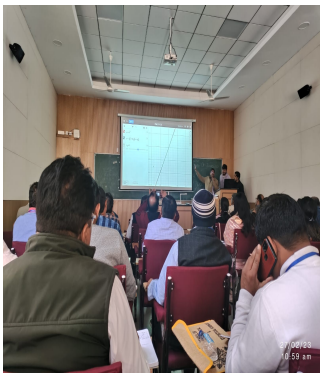
Report Day 1 ~ Dated 26th February 2023

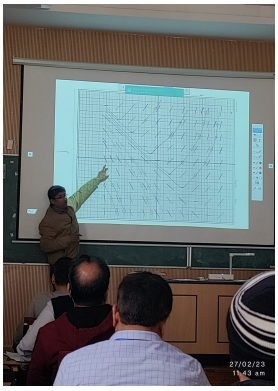
The day started with the introduction of all faculty members who are going to take sessions for the coming days. After the introduction of all faculty members,Prof Manoj Thakur took the first session on Obstacles and Challenges experienced by teachers in Mathematics Education. The session was based on the discussion related to challenges such as the race between finishing the course and clearing the concepts, difficulties teachers face during result based teaching,group learning in a resource constrained environment, sufficiency of homework, difficulties we face in active teaching and learning and their possible solutions we discussed with Prof Manoj Thakur. The solutions came out after this discussion were as customising the syllabus according to the need of the students and customising the homework for average number of students.We discussed on other number of things with the professor such as the how to fill the gap between CBSE and NTA exams,how to disseminate the fear of maths in our students.Altogether the session was highly interactive and a good start for us here in IIT Mandi.

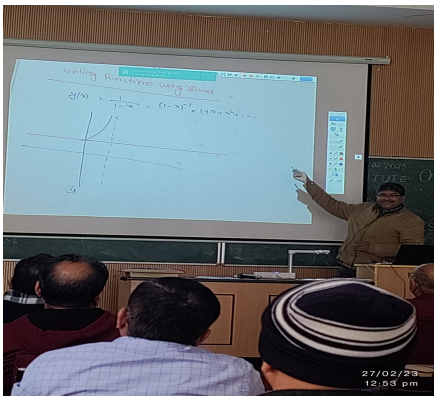
The second session on SETS and FUNCTIONS was delivered by Dr. Saswata Adhikari. The session began with the definition of sets i.e., collection of well defined distinct elements and then there was discussion on injectivity and surjectivity of functions. Dr Saswata showed various methods to check injectivity and surjectivity.Then there was discussion on domain and range of a function and how domain play a role in deciding the nature of a function in terms of injectivity Dr Saswata then focused on the need for a function which is to connect two sets and then deriving properties of one set using others'. After that few of our colleagues asked a number of questions regarding pre image and inverse image which were fully tackled by Dr. Saswata.

Report Day 2 ~ (27 February 2023)

- Today's topic dated 27 February 2023 was calculus and its application in real life which was delivered by Dr Anil Kishen. He started with explanation of the domain and range of continuous and discontinuous functions using different functions like $Y=\sqrt{1-x}$. He also explained very well removable discontinuity using the examples of function. $f(x)=\frac{x^4-4}{x-2}$ and the limit concept was very well explained using one-sided limit and two sided limits.
- He was able to relate limit of functions to find the difference between average velocity and instantaneous velocity is the velocity by using the real life example and through graph also.
- He explained the method of increments using the First Principle Method, algebraically and graphically both in which he found out the derivative of the function $y=ax^2$.
- Application of derivatives was also shown graphically for building the bridge with the interpretation of slope with the solution 'why the slope should not be more than 45°? '
- He also explained the concept of negative time.
- Next he explained graphical solution of differential equations through lineal elements by the process of zooming in the graph.
- He explained Lagranges Mean Value Theorem using the example $f(x)=x^3-3x^2+x$
- He also took the analogy for application of calculus to find the level of water after time t while emptying a full water tank through a hole made at the bottom of the tank graphically.
- He explained infinite Taylor Series graphically using the example $y=\sqrt{x}$.
- He explained maxima minima of the function $y=\frac{x^3}{3}-2x^2+3x+2$ using the slope changing from +ve to zero to negative. Then he also explained relative maximum /minimum values and local maximum /minimum values depending upon the domain of the function .
- He described application of differential equations in nuclear reactors and explosions .
- He explained that it is not mandatory to have the solution of a differential equation in the domain of the given function.
- He explained exponential and logarithmic function graph .
- He also explained the how to find $\sqrt[3]{5}$ using error analysis method.
- In the end, he conducted the activity with the group members to solve the practical problems using projectile motion.



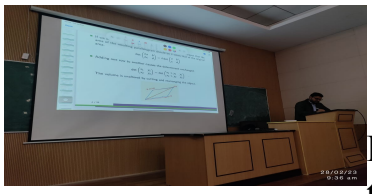




Report Day 3 ~Dated (28/02/2023) Morning.

- The first session was taken by Dr Samir Shukla a highly energetic professor of IIT (Mandi).
- The topic of the discussion was 'UNDERSTANDING DETERMINANT GEOMETRICALLY '
- Initially he introduced the determinant of a 2x2 matrix as a area of parallogram and 3x3 matrixas volume of parallellopiped and he extend this for n dimensional as well.He wonderfully explained the properties of determinant geometrically .
- He highlighted the famous Pythagoras Theorem $x^2+y^2=z^2$ which has many integral solutions in contrast of Fermat's Last Theorem $x^n+y^n=z^n$, n>2which do not posesses any positive integral solution.
- He illustrated the applications of matrices and determinantsin forming System Of Linear Equations with the help of real life situations like ticket booking and information on IRCTC website.
- He emphasised that teaching mathematics is quite easyif connected with the previous knowledge of the student but also focused on abstract thinking in Mathematics learning .
- Hecited examples of famous colouring problem, making schedule or timetable satisfying a number of constraints .
- He also threw light on the properties of n-dimensional objects like calculating distance etc.
- Famous "Konisberg Bridge Problem "was today's attraction.
- At the end there was a healthy & fruitfuldiscussion on " Why Do So Many People Positively Dislike Mathematics".

- He concluded the session by quiting the contribution of reknowned mathematician 'Manjul Bhargava' of indian origin who was awarded prize for his extraordinary work in 'Algebraic Number Theory'.
- The silence broke with a huge applause of the participants.



Inauguration of Faculty Development Programe(FDP) in Mathematics for PGT Mathematics at IIT Mandi (HP) 25th February -3rd March 2023

Dr Kripa Shankar Upadhyay RDE (East) , Directorate of Education as a representative from Director of Education DoE, NCT of Delhi was welcomed by Professor Laxmidhar Behera, Director, IIT Mandi.

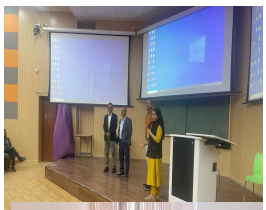
Dr Sarita Azad, the Cordinator of the programme assured him to meet the requirement of enthusiastic participants from DoE through this programme.

Director IIT Mandi incepted the programme by taking views of the Lecturers (Mathematics) from Delhi about their learnings so far from the workshop.

Responses from participants were

- Learning in the peaceful and fresh environment.
- Interpretation of concepts to higher level.
- Thought provoking, abstract thinking and clarity of concepts.

Dr. K.S. Upadhyay congratulated the participants for attending such a wonderful programme initiated by SCERT Delhi. He thanked the Director IIT Mandi and its Faculty Members for their effective sessions and wonderful hospitality .
Director IIT Mandi thanked Dr K.S. Upadhyay for this revolutionary step for the Delhi Govt School Teachers .This initiative taken by Delhi Govt. for such a workshop for Maths Teacher was apprecited by Dr Behera .
The faculty members of IIT Mandi appreciated the inquisitiveness and promptness of the participants .
The Coordinator of the programme mentioned that participants were so enthusiastic that all the faculty members who were taking sessions were on toes all the time.
In the end, Professor Laxmidhar Behera (Director IIT Mandi. HP) gifted him Himachal traditional Cap and shawl.






Second Half session ' Method of Proof' was deliverd by Dr Sampat Kumar Sharma

- The session began with introduction of 'Well Ordering Principle' Various Methods of Proof : Proof by deduction, by Mathematical Induction, by citing counter examples , by Contrapositive methods were discussed using relevant examples . The statement of number theory " Every Number can be written as sum of square of three integers was disproven by counter examples of 7. This was an interesting part of the session . Participants were actively involved in finding the counter example.
- The concept of prime number was another interesting feature of the session . The explanation for 'why 1 is not a prime number 'was an attraction for all the participants it was beautifully explained using the fundamental theorem of arithmetic. Session ended with some fascinating conjuctures like Twin Prime conjucture Goldbach's Conjucture the short trick to findwhether a given number is is prime or composite was proven in the session.participants verified the trick using different numbers . Overall session was informative . Participants were fully involved in the discussionand derivationby Dr sampat kumar sharma . At the end participants gave a huge applause.

Report Day 4 ~Dated (01/03/2023) Morning.

- On this day of First March 2023 a pleasent and cloudy morning was started with the session of Dr Sarita Azad . She introduced the topic of "PROBABILITY THEORY- THE FOUNDATION OF STATISTICS "relating to our previous knowledge of mean, Variance & Standard Deviation.
- She also gave demonstartion on unbiased estimator which was very interestingand innovative.
- Shr related the probability of happening of different events in future using present and past experiences and sitiutatios of the experiment.
- She also discussed the probability of distribution of various continuous and discrete variables.
- She also gave demonstration related to various parameters of epidemics like Swine Flue, Covid 19 etc , which grabbed everyones attention .

Session II , mainly dealt with formation amd application of Baye's Rule and theorem .

- Dr Amulya kumar Mahto discussed about Normal Probability Curve which is applied in formulation of different problems and policies. The application of NPC in daily life situations was main attraction and innovations among participants.

Session III was started by Mr Om prakash Kshatriya- B. Tech IIIrd Year student (Data Science) and Mr Vanshraj Nathani- BTech IIIrd Year Student (Electrical).

- All the participants were overwhelmed by their knowledge assimilation and distribution. They both discussed very interesting problems like 'The Monte Hall Problem 'and Prisioner's Room Problem which grabbed attention of all the participants . all the participants took part actively and enjoyed solving those problems.

- Ist March 2023 was celebrated as Foundation Day of IIT, Mandi(Himachal Pradesh)
- The programme was started with the lightening of Lamp by Dr.Laxmikant Behra (Director IIT Mandi) followed by Saraswati Vandana , Annual Report by speches by some well known personalities .Folk Dance Performance by trained professional of Kalahari District Orissa .
- Some performance of students of IIT Mandi also grabbed attention.
- In all we can say session was very informative anmd fruitful which initiated abstract thinking among the participants.

Report Day 5 ~Dated (02/03/2023) Morning.

- First session was on decision making using Mathematical Modelling by Professor Manoj Thakur . He beautifully executed practices to bring together rersearch and practice. He was the best presenter who shared relevant practices that we can use by crafted PPT's.
- Paticipants were encouraged to use technology in teaching many topics.
- Second session was introduction of Differential Equation by Dr Preeti . She instilled such enthusiasm in use and abridged the gap between academic learning and its practical implimentation.
- After Lunch session was on application of Integration by Om Prakash Kkshatriya and Vanshaj Vijay Nathani from BTech 3rd year students. Their class eas very informative , educative and eye openeras it helped to dispel many perceptions.
- Workshop ended with a great provation. Best and unique practice in teaching- learning is essentially a kind of revolutionary approach to achieve something which has not been able through our traditional way of doing things . So that entire voloume of knowledge can be used for improving teachers education scenario and thereby improving teaching learning process.
- Brain stroming session among the team members Comming together is begining, staying together progress and working together is a success. Every one was greatful to be part of lifetime experiences and looking forward to attend these type of sessions time to time.