



# INSTITUTE OF SMART STRUCTURES AND SYSTEMS

(A Society registered under Govt. of Karnataka)

Department of Aerospace Engineering, Indian Institute of Science, Bengaluru-560 012, India

<https://isssonline.in/>

## Annual Report (Sep. 2021 – Aug. 2022)

The following report is for the activities and events during the period Spetember 2021 to August 2022

### Summary of Activities

- Lecture series and discussions
  - PMRF-IISc courses
  - Sukshma webinars
  - Workshops/ FDPS/ Value Added Courses
- Publications: Journal, Sukshma Newsletter, Website
  - ISSS Journal
  - Sukshma Newsletter
  - Website updates
- Chapter activities
  - Hyderabad chapter
- Administrative activities
  - Inclusion of new volunteers into ISSS activities
  - Internet banking
  - GC meeting and new financial auditor
  - Additional office assistant position
- Outreach
  - MoU with the APSCON-23 (IEEE Sensors Council Conference)
  - 5<sup>th</sup> MEMS Cimmunity Chip acitivity (2<sup>nd</sup> from ISSS)
  - International outreach
  - Industry interactions
  - Technology cluster formation
  - Sukshma Avishkar
- General Updates
  - Membership statistics
  - Announcement of Academic Membership schemes
  - Announcement of ISSS Awards 2022
  - Acknowledgments

#### Founder President

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## 1. Lecture series and discussions

### a. PMRF Lecture modules:

PMRF is a programme of the Government of India, details of which can be found at <https://dec2020.pmr.in/>. Under this programme, selected PhD scholars at IISc, IITs, and IISERs are recognized with the PMRF based on their academic and research performance. There is a requirement that PMRFs should also teach outside their institution for at least one hour per week, on the average. Under this activity, last year there were 17 courses offered as against 28 courses being offered this year by PMRFs. Also this year PMRFs from IIT Kanpur and IISc used ISSS platform to undertake their teaching assignment. Many PMRFs have completed their teaching using this platform. Going forward ISSS will be making the enrolment of registrants for the courses on a payment basis. This activity started in 2021 and since then has gained popularity and momentum. From this year the PMRF who wanted to use ISSS platform was required to become an ISSS member.

The registrants for the courses were students at undergraduate, post-graduate and PhD level. In 2022 we have had students and faculty members from outside India registering and attending the courses. In some courses especially related to biotechnology the number of registrations exceeded 700. The enrolment and course titles for the past year are furnished next.

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Sl No	Course title
1.	Basics of cellular and molecular neuroscience
2.	Introduction to Product Design
3.	Structural Biology
4.	Material and Electrical Characterisation Techniques
5.	Compliant mechanisms
6.	PDE fluid flow and heat transfer
7.	Introduction to Machine learning
8.	Quantum Mechanics-I
9.	Fluid Mechanics through pictures
10.	Antennas in Radio-astronomy
11.	A practical approach to seismic method using python and Machine learning tools
12.	Module for thermodynamics and statistical mechanics
13.	Introduction to FEA
14.	Quantum Mechanics-Problems in One Dimension
15.	Solid State Physics for Engineers- 1
16.	Optimization Methods
17.	Phyton in Hydrology
18.	Basics of operating systems
19.	Digital Electronics
20.	Fluid Mechanics and heat transfer

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21. Introduction to biological cell
22. Introduction to continuum mechanics
23. Introduction to controller synthesis
24. Introduction to Numerical Methods
25. Linear Algebra
26. Optimization methods
27. Probability theory
28. Vector Space linear algebra

Some testimonials and feedback from registrants are in the appendix

## b. Sukshma webinar

The following Sukshma webinars were conducted by the ISSS Hyderabad chapter in the past year

- Prof. Slava Krylov, Tel Aviv University, Israel, 10 September 2021.
- Prof. Shuji Tanaka, Tohoku University, Tohoku, Japan, 23 October 2021
- Prof. Walter Lacarbonara, SAPIENZA University of Rome, Italy, 19 November 2021
- Dr. Chandrasekhar Nair, Bigtec Labs and Molbio Diagnostics, Bangalore, India, 21 January, 2022
- Prof. Rohit Srivastava, Department of Biosciences and Bioengineering, IIT Bombay, 25 March 2022
- Prof. Arockiarajan, IIT Madras, 17 June 2022,
- Prof. Sneha Prabha Narra, Carnegie Mellon University (CMU), 8 June 2022
- Prof Achyut Ghosh, BE Mech (1961) Consultant, Invitee TAG NCRTC New Delhi, 27 August 2022

Every speaker was given an honorarium or a memento. ISSS wishes to express gratitude to all the speakers and Prof. Pandey for coordinating these webinars

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c. Workshops/ FDPS/ Value Added Courses

The following programmes were carried out by various educational institutions under ISSS banner

- **Technical talk series "Sukshmabhilap Malika 2022"**, Centre for Nano Materials and MEMS, NMIT, Bengaluru

The Centre for Nano Materials and MEMS at NMIT, Bengaluru in collaboration with the Institute of Smart Structures and Systems (ISSS) organized an online technical talk series "Sukshmabhilap Malika 2022", on 'Recent Trends in MEMS Technology' on 5th and 6th of May 2022. Around fifty participants from all over India participated in the talk series including students, research scholars and faculty members.

**Webinars and Certificate courses: Rajalakshmi Engineering College, Chennai**

*International Webinar:*

Dr. Bruce K Gale, Professor and Chair, Department of Mechanical Engineering, University of Utah gave a talk on "Inertial Microfluidics" on 4<sup>th</sup> April 2022. It was conducted both in online and offline platforms. 32 online and 60 offline participants were benefitted

*Certificate Courses:*

A certificate course was conducted on "Microfluidics" on four Saturdays starting from 5<sup>th</sup> March to 26<sup>th</sup> March 2022. It was conducted offline and 23 participants were benefitted

A certificate course was conducted on "Microfabrication of MEMS Devices" on four Saturdays starting from 2<sup>nd</sup> April to 23<sup>rd</sup> April 2022. It was conducted both in online and offline platforms. 10 online and 25 offline participants were benefitted

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- *A Value-added Course on “Design and Simulation of MEMS Devices”, Department of Electronics and Communication Engineering of BMS College of Engineering College, Bengaluru*

The Department of Electronics and Communication Engineering of the BMS College of Engineering, Bengaluru, Karnataka organized a value-added course on the “Design and Simulation of MEMS Devices” from 20th June to 4th July, 2022 to expose the participants to the design of MEMS Devices and their simulation using COMSOL Multiphysics software. The course included discussion on the design and simulation of devices such as, cantilever, accelerometer, displacement-amplifying compliant mechanism, the stiffness of beam suspensions using COMSOL Multiphysics software. Around twenty-five students of BMS College of Engineering, Bengaluru participated in this course

## 2. Publications: Journal, Sukshma Newsletter, Website

### a. *ISSS Journal*

The journal is a technical publication of the Institute of Smart Structures & Systems. The journal is counselled by a number of world-renowned national and international experts on the editorial board, with Prof. S Gopalakrishnan as the Editor-in-Chief. This interdisciplinary journal explores the relationships between smart materials, structures and systems, serving as a primary communication conduit for scientists investigating the areas of micro and smart structures, systems and properties of smart engineering materials. Coverage spans a wide spectrum of disciplines and topics, including Multiphysics, Bio-nanotechnology, Smart Materials, Sensing and actuation, Fabrication technologies, Electronics, RF MEMS & MOEMS, Energy harvesting, Smart Structures, Structural Health Monitoring, Controls and Applications. This journal follows a single blind peer review process and hybrid publishing model.

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- Volume 10 issue 1 in June 2021 and Volume 10 issue 2 in November 2021 were published totalling 8 and 7 articles per issue respectively in 2021. In the year 2022, the first issue published in June was a Special Issue on Advances in Photonics 2021-2022 consisting of 19 articles.
- In the year 2021, the journal took 61 days from submission of an article to first decision and 25 days from acceptance to online publication.
- The number of downloads of the journal articles increased 3x times as compared to the previous year to almost 5000 downloads
- 52 manuscripts were submitted in the year 2021 out of which 24 were accepted. Until July 2022, 18 manuscripts have been submitted and 15 have been accepted. Majority of the manuscripts submitted to the journal are from India; however, the submissions from Russian Federation, Germany, United Kingdom, Bangladesh, Canada, Iran, Tunisia, Ukraine are increasing gradually.
- The circulation of the journal in the international community has also increased significantly from 1905 institutions in the year 2020 to 3541 institutions in 2021 with the aid of 'Exposure via online deals'.
- The requests for full-text articles has increased from 1304 in the year 2018 to 9457 (YTD) in 2022 (4955 requests in 2021).
- Manuscripts are being accepted for Special Issue on Smart Materials and its Applications. This special issue is being edited by our Guest Editors - Prof. Bishakh Bhattacharya, Indian Institute of Technology Kanpur, India and Prof. Arokiarajan, Indian Institute of Technology Madras, India
- All the accepted papers between January 1 and December 31, 2022 to the ISSS Journal of Micro and Smart Structures are going to be considered for the Sri Josyula Seshadri Sastry Best Paper Award.
- The journal is a member of Committee on Publication Ethics and no manuscripts were retracted last year.

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# INSTITUTE OF SMART STRUCTURES AND SYSTEMS

(A Society registered under Govt. of Karnataka)

Department of Aerospace Engineering, Indian Institute of Science, Bengaluru-560 012, India

<https://isssonline.in/>

- ISSS wishes to thank Prof.Gopalkrishna Hegde the chief editor of the special issue on Advances in Photonics 2021- 2022 for all the effort
- ISSS is grateful to Prof.Gopalakrishnan, editor in chief of ISSS Journal and Ms.Shweta Paunekar, Journal manager for all the coordinated effort in increasing the foothold of the journal
- ISSS is grateful to all the researchers who contributed their article for the journal

## b. Sukshma Newsletter

It gives us immense pleasure to share that we have successfully revitalized the publication of Sukshma after a gap of three and half years. The latest issue is Vol 12 No.1 and is available on ISSS website in the following link

<https://isssonline.in/>

The latest issue of Sukshma Newsletter contains a brief report on the ISSS Awards-2021 and the highlights of the event सूक्ष्म संरचना Sukshma Samrachana-2021: the MEMS Innovation Challenge. In this issue, we have presented the names of the ISSS Awardees under different category and the associated articles from the awardees work. The names of the winners of the MEMS Innovation Challenge have also been published in the this issue of Sukshma.

Considering the importance of the vision of an “Atmanirbhar Bharat Abhiyaan” in electronics and semiconductors, this edition of the newsletter has presented a contemporary article entitled “India’s Semiconductor Mission”, contributed by Prof.Anurekha Sharma.

During the pandemic, ISSS successfully organized and conducted several activities such as technical lecture series, webinars, and workshops. This edition of the Newsletter has briefly reported all the activities.

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ISSS is providing an online teaching platform to Prime Minister Research Fellows (PMRFs). This edition has a report on ISSS PMRF Lecture Series. We have also covered a book review, which is written by Prof. G. K. Ananthasuresh on "Primer on Engineering Standards", which is authored by Maan H. Jawad and Owen R. Greulich and published by ASME Press in 2014. The next issue of Sukshma will be released very soon. It was a wonderful teamwork to bring the Sukshma in its new manifestation. ISSS wishes to acknowledge the editorial board lead by the Editor in Chief Prof. Nilanjan Chattoraj, Prof. Anurekha Sharma, Dr. Anjana Jain and Prof. Sunil Maligi. We hope to bring a lot of interesting issues of Sukshma Newsletter in the coming future and request all ISSS members to contribute articles.

### c. Website Update

- All activities of ISSS are constantly updated on ISSS website
- ISSS has a separate portal where all PMRF Lecture recordings are made available to registrants
- Going forward ISSS will introduce log in feature for members and also blog pages and a mentoring platform for members

## 3. Chapter Activities

### Hyderabad Chapter

- The ISSS Hyderabad Chapter conducted 8 Sukshma webinars in the past year
- Prof. Ashok Kumar Pandey is appointed as advisor to the Academic ISSS Member, NITTE Meenakshi Institute of Technology for a period of one year and has advised the institution researchers of various Gyroscope designs
- Prof. Pandey Chaired the first level scrutinizing committee of the STARC MEMS Innovation Challenge contest
- The Hyderabad Chapter has requested the ISSS GC to grant the one time "Sri C.S. Sastry and Sri G S R Sastry Memorial Award" as a part of their Technology Award for the next year as no valid applications were submitted.

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## 4. Administrative activities

### a. Inclusion of new volunteers for new initiatives

- A meeting was held with new volunteers of ISSS on 31<sup>st</sup> July 2022.
- The following new initiatives were discussed
  - ISSS Community chip activity (region wise)
  - Sukshma Avishkar
  - Formation of technology research clusters
  - Academic membership schemes
  - Industry outreach
- The meeting was attended by Dr.Sripad, Prof.Chirosree Roy, Prof.Sthuthi and Prof.Sunil

### b. Internet banking:

- Internet banking has been enabled for the ISSS bank account and all payments are happening online
- QR code has been generated for UPI payment and all membership payment can be done through UPI payment through an online form <https://isssonline.in/members/>

### c. GC meeting and new financial auditor

- There were four GC meetings and two office bearers meetings held between September 2021 and August 2022
- Financial approvals for new initiatives and suggestions for execution of new initiatives were given by the GC
- The 22<sup>nd</sup> AGM in the year 2021 approved the new financial auditor Vasanth and Company. The new financial auditors have conducted the financial audit for the year 2021-2022

### d. Additional office assistant position

- With increase in ISSS activities it was found that an additional office assistant position be filled
- The same was approved by the GC and the job has been advertised on ISSS website. <https://isssonline.in/career-openings/>
- The position will be filled after shortlisting the applications and followed by an interview

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## 5. Outreach

### a. MoU with the APSCON- 23 Organizing chair

- The MoU between IEEE Sensors Council conference on Applied Sensing (APSCON-23) and ISSS has been signed with ISSS being the platinum patron of the conference
- Earlier an MoU was signed between ISSS and IEEE Sensors council which for technical reasons could be taken forward
- ISSS Members are co-chairing many sessions in the Applied Sensing conference (APSCON) to be held from Jan 23-25 2023 in Bengaluru. More details about the conference can be found on the conference website <https://2023.ieee-apscon.org/>
- ISSS has been allotted a slot during the second day to highlight/showcase the activities initiated

### b. 5<sup>th</sup> MEMS Cimmunity Chip acitivity (2<sup>nd</sup> from ISSS)

- ISSS has initiated the activity of coordinating the next round of community chip
- ISSS GC has requested Dr.Sripad to coordinate the activity at the country level. ISSS GC has also identified the region wise coordinators for the activity.
  - East region coordinator- Prof. Chirosree (IEST), Prof. Nilanjan (NIT), Prof.Anirban (Radio University)
  - West region coordinator- Dr. Jayu Kalambe, (Sri Ramdeobaba college of Engineering and management, Nagpur)
  - North region coordinator- Dr. Anil Arora (Thapar University)
  - South region coordinator- Prof. Lakshmi (MSRIT), Prof.Sunil (BMSCE), Prof.Sthuthi (NMIT)
- The fabrication will be on paid basis. Each institution will be required to pay for the area occupied by their device design in the die.
- The devices will be fabricated in the MPW run of InFab Technolgies in CeNSE IISc
- All interested institutions have been asked to fill the form through the link <https://docs.google.com/forms/d/1QLJ2bz3K1J-gh5Yot5Vxm6DGChc439xkD-j6DHII4tc/edit>

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## c. International outreach

- Prof.S.Mohan and Dr. Raghu Upadhyaya have helped ISSS to strategize ISSS international outreach
- Strategy to invite lead researchers outside India in relevant domain of research to join ISSS is being initiated
- These researchers will be requested to deliver courses and lectures to industry and academia and there by reach out to more researchers outside India
- With the help of our social media managers coordinated by Prof.Stuthi have shortlisted lead researchers who are alumnus of IITs and IISc outside India through LinkedIn Social media platform. ISSS will try to reach out to these researchers and conduct some activities

## d. Industry interactions

- Under the mentorship of Prof.S.Mohan, the following team was formed to coordinate the industry interaction of ISSS: Shri.Gurudutt, Dr.Giridhar and Dr.Sripad. ISSS also would like to acknowledge the suggestions and contribution of Dr.Raghu Upadhyaya and Prof.Aatre in this outreach.
- A strategy to increase industry outreach from ISSS has been formed
- The needs of Indian industries and industries outside India has been understood
- At a broad level the following are the needs of the industry
  - Workshops, courses, and training in the area of interest to the industry
  - Networking for identifying appropriate funding agencies- both domestic and international
  - Interaction with faculty and industry through ISSS
  - Faculty members as consultants in niche areas cross disciplines and areas in different institutions and departments and ISSS could find these faculty members
  - Availing and connecting facilities like characterization / testing/ packaging/ additive manufacturing etc.

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- To address these needs ISSS will try to get into an agreement with lead institutions and help industries take leverage of the facilities and expertise in these institutions
- e. Technology cluster formation
- Three technology cluster formation under ISSS platform has been initiated under a lead researcher
    - Agricultural Sensors cluster: Prof. Jose Joseph, Digital University, Kerala
    - Structural Health Monitoring cluster: Dr Ramesh Sundaram, NAL, Bengaluru
    - Biosensor Cluster: Prof. Hardik Pandya, IISc, Bengaluru
  - These technology areas were chosen as the lead researchers in this domain as lead researchers as they are experts and have shown passion to form and coordinate the cluster activity
  - A “Technology cluster” is a group of organizations who work in the common technology area and who want to take leverage of facilities, expertise from the consortium
  - The aim of this activity is to bring together researchers and organisations (academic and industry) to form a consortium and they by get into collaboration
  - The various objectives of the cluster are
  - *Objective 1:* Each cluster will have a lead institution and nodal institutions.

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# INSTITUTE OF SMART STRUCTURES AND SYSTEMS

(A Society registered under Govt. of Karnataka)

Department of Aerospace Engineering, Indian Institute of Science, Bengaluru-560 012, India

<https://isssonline.in/>

- *Objective 2:* Each cluster will look towards forming its own policy for research collaboration to include the following but not limited to the following
  - Conducting workshops, training programmes and symposiums for industry and academia
  - Have exchange of students and faculty members
  - Optimal use of infrastructure and help in finding better infrastructure nationally and globally
  - Have joint publications
  - In case of IPR to be exchanged, a specific MoU will be signed between the interested institutions
  - Write joint proposals for funding. The consortium can have academic institutions as well as industries
  - ISSS will facilitate the formation of clusters and help in the initiatives taken. The technical research and other modalities will be left within the consortium partners

f. Sukshma Avishkar

- ISSS is deciding on the modalities to initiate a region-wise Sukshma Avishkar (idea contest)
  - First level: Idea formulation
    - Selected groups will get seed money and a mentor.
  - Final round proof of concept
    - Should show implementation of concept
- Different domains
  - Industry to give basic specifications (Get industry inputs and form a larger group to work on this)
  - Defense sector specifications
- In the second phase seed money will be provided to students along with assigning a mentor to successfully implement the idea and bring out a prototype

---

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## 6. General Updates

### a. Membership statistics

- Membership under different categories during the period September 2021 till date

Institution / Corporate Membership: 02

Life Member: 28

Annual Member: 02

Student Member: 46

- Overall status of membership under various categories

Institution / Corporate Membership: 22

Life Member: 812

Annual Member: 02

Student Member: 49

### b. Announcement of Academic Membership Schemes

- It has been found that academic institutions need to have a clarity on what benefits ISSS can offer to them.
- On ISSS GC approval various category for academic membership was formulated. The three categories are
  - Silver
  - Gold
  - Platinum
- The details of each category are provided in the appendix

### c. Announcement of ISSS Awards 2022

The ISSS awards for the year 2022 have been announced. There are awards under the UG, PG and PhD category for students. Also, there are awards under Young Scientist and Technology category. The last date to file the nominations is **10<sup>th</sup> November 2022**. More details can be found in the link

<https://isssonline.in/isss-awards-2/>

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## d. Acknowledgments

- Prof.V.K.Aatre for all the mentoring, motivation and suggestions to carry forward new initiatives
- Prof.Ananthasuresh for initiating many new activities like Technology cluster formation, contribution to Sukshma Newsletter, MEMS community chip activity, STARC MEMS innovation challenge contest etc.
- Prof. S. Mohan for help in industry and international outreach
- Dr.Raghu Upadhya for help in industry and international outreach
- Prof.Gopalakrishnan for leading the ISSS Journal editorial board and increasing ISSS journal outreach and publications
- Shri.Gurudutt for suggestions in industry outreach
- Prof.Nilanjan Chattaraj for reviving the Sukshma Newsletter. ISSS wishes to thanks all the contributors to the Newsletter
- Prof.Sunil Maligi for help in updates to ISSS website, coordinating ISSS MEMS community chip activity etc.
- Dr.Sripad for help in ISSS MEMS community chip activity and industry outreach
- Prof.Jose Joseph for showing passion and interest to lead the Agriculture sensor cluster
- Dr.Ramesh for showing passion and interest to lead the SHM cluster
- Prof.Hardik Pandya for showing passion and interest to lead the biosensor cluster
- Dr. Sripad to help in ISSS community chip activity and also in industry outreach

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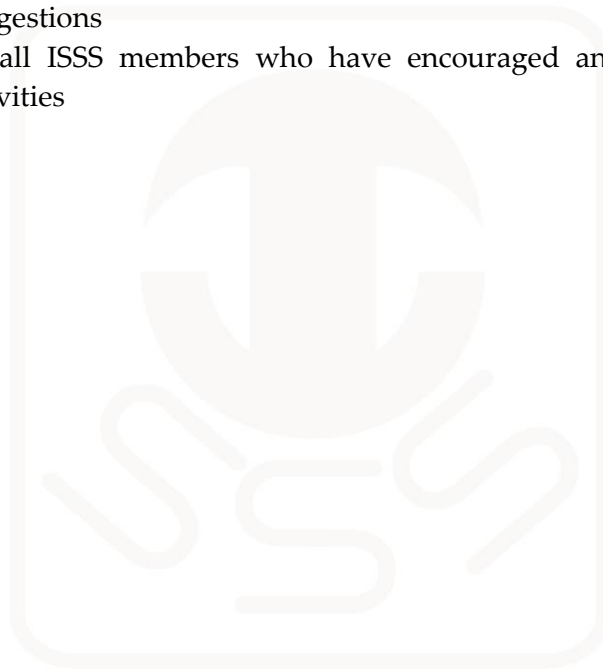
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- Mr.Gururaj, Ms.Sushama Upadhyya and Mr.Srinivas for helping ISSS website updates
- Ms.Shwetha Paunikar as ISSS Journal manager and Springer for publication support
- Dr.Rajath, Mr.Chandrashekhar, Mr.Amruth Pawar and Ms. Keerthana G as social media managers
- Ms. Madhumitha for all poster and brochure designs
- To all the office bearers and GC members of ISSS for constant support and suggestions
- To all ISSS members who have encouraged and participated in ISSS activities



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## Appendix

### Some feedback and testimonials from PMRF course registrants

Course: Cell Mechanics

PMRF Student (Course instructor): Ms. Anwasha Barua

Student name: Renu Maanzu

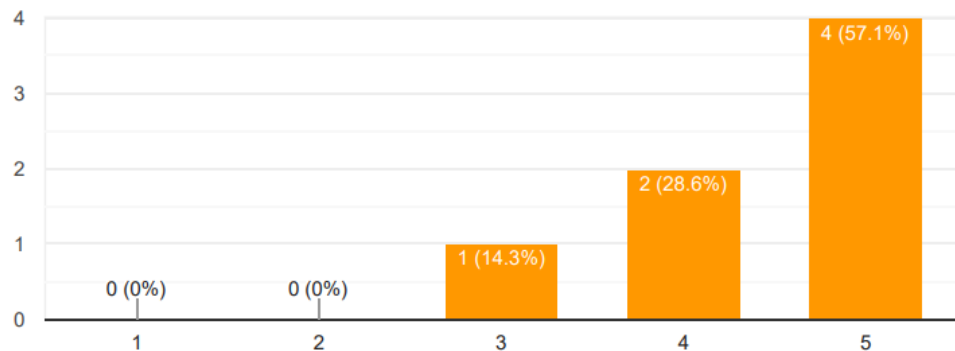
Feedback received: Thank you so much ma'am. It was a great experience learning from you. You not only delivered subject information but also motivated us a lot towards research field. Well, you are already a star for us as you are at a position for which thousands of us dream about but still, I want to wish u a good luck for your future endeavours.

Course: Biological Cell

PMRF Student (Course instructor): Ms. Mithali Shah

Assessment of the instructor from all participants

Rate the clarity of the instructor ( 1= could not understand; 5 = crystal clear)



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ISSS Corporate Academic Membership	
Amount in INR	Benefits
<b>Silver Member</b>	
15000 one time	Annual Membership for one faculty: to be nominated by institution
Else Rs. 7500 for yearly renewal	Mentoring the faculty- design of courses/curriculum in one area
If inactive for 5 years an activation fees of Rs.5000	Mentoring platform for student members
	Discounts in workshops/ FDP/ Foundation courses/ conferences
	ISSS Expert Seminar on 1 topic - one per year
<b>Gold Member</b>	
25000 one time	Membership for up to 5 student and 2 faculty: To be nominated by the institution
Else Rs. 12500 for yearly renewal	Discounts in workshops/ FDP/ Foundation courses/ conferences
If inactive for 5 years an activation fees of Rs.5000	ISSS Expert Seminar on 2 topics - 2 per year
	Mentoring platform for faculty
	Mentoring platform for students' members
	Organising workshops /conferences, help with resource persons

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Platinum Member	(Eligibility Criteria: Minimum one faculty should already be a life member)
50000 one time	Include 25 student members and start a student chapter
	Discounts in workshops/ FDP/ Foundation courses/ conferences
	Mentoring platform for students members
	Mentoring platform for faculty
	Institutional Mentoring to set up research facilities
	Organising workshops /conferences, help with resource persons
	Become part of a consortium of research institutions coordinated by ISSS
	Center of Excellence: Eligibility for ISSS guidance and annual awards for CoE
	Help in research grant proposal review in relevant technologies



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