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# **IIRS Outreach Programme**

## **Distance learning Programme**

### **Annual Report 2021**

**Indian Institute of Remote Sensing**  
Indian Space Research Organization  
Department of Space, Government of India  
Dehradun

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## Executive Summary

Distance learning is the process of creating an educational experience of equal qualitative value for the learner to best suit their needs outside the classroom. Distance Learning Program (DLP) offered by Indian Institute of Remote Sensing (IIRS), Indian Space Research Organisation (ISRO), is an initiative for training students and professionals from academia and user departments in the field of geospatial technology & Earth Observation. IIRS DLP started in the year 2007 with 312 participants from twelve universities in India. Till December 2021, IIRS has successfully conducted **102** outreach programmes through live and interactive classroom mode (also known as EDUSAT programme) benefitted more than **4.62 lakh** participants from **3034** network Institutions distributed across the country. During last fourteen years, IIRS has successfully established a network of academic and professional Institutions in the country under this programme. The content of IIRS Distance Learning Program (DLP) focuses on teaching Basics topics along with technological advancement in the field of Remote Sensing, GIS, GNSS and its applications. The online sessions delivered under this programme are interactive and majority of such sessions/lectures of these courses are delivered by Subject Matter Experts (SME) from IIRS and also guest faculty from other ISRO centers.

All the courses of IIRS DLP are made available through in-house developed **Electronic Collaborative Learning and Knowledge Sharing System (E-CLASS)** platform which enables various innovative learning tools to the participants such as attend the live sessions, post queries, download study material, attend offline sessions, appear for online examinations and download course certificate etc. IIRS has strengthened its online learning platform and customized new short term online certificate courses on various topics of geospatial technology and its applications. These courses were made available for wide range of online learners such as students, university faculty, government officials, defense personals, professionals from industry and entrepreneurs. During online courses, the experts from ISRO and other knowledge Institutions shared their knowledge and experience with the course participants. The live sessions are also made available through social media video streaming platform YouTube. The E-CLASS platform of IIRS has emerged as an effective tools for teachers and online learners. The live sessions for large number of participants were successful conducted by using E-CLASS platform. IIRS has successfully scaled up the technology and IT infrastructure to meet the large user requirements in year

2021. The cluster computing based system architecture proved to be one of the best solution for getting required performance of the system during live sessions to handle large number of user logins.

During the year 2021 IIRS has conducted **30** online courses/workshops/webinar series. A total **1, 97,737** participants from **1477** unique Institutions participated in these online courses. About **47, 609** (certificate generation is in progress for few courses) participants has successfully completed the courses after attaining minimum attendance/ scoring minimum passing grades in the online examination. These courses includes 2 special customized courses benefiting 7338 participants, 05 special courses during covid-19 lockdown benefitting 43873 participants, 08 advanced courses benefiting 65970 participants, 6 courses on Basics of RS &GIS benefiting 37586 participants, 6 full day workshops benefiting 37119 participants, 3 international webinar series benefiting 5851 participants.

The participant's data was further analysed and it was observed that out of total **197737**, **138199** were **male** and **59534** were **female** participants. The data also shows that **81.89%** participants are **students**, **18.11%** are **working professionals**. The data was also analysed in terms of the age group of the participants. Interestingly it was noted that the participants of all the age group are participating in online courses of IIRS. It was observed that the maximum participation was in the age group 18-25 years. Most of undergraduate and post graduate students are in this category. Around 41063 participants including students and professionals of age between 26 to 40 years have joined IIRS online courses in year 2021. About 4551 participants who are less than 18 years of age have also attended the courses. It was encouraging to note that around 116 senior citizens have also shown interest in the online courses of IIRS.

IIRS has also conducted online summer school for school students in the month of July 2021. The course was also open for international students. Total one lakh students (maximum limit) from 64 countries as registered for this course. The registration includes 31,152 students from class X, 20,611 students from class XI and 48305 students class XII. Further the education board wise distribution of these students includes state board 42,990, CBSE board 46,078, ICSE board 5334 and other students (including international students) are 5,656. During this course total 10 online sessions were conducted and 15,183 students have successfully completed the course.

The data for year 2021 depicts that even though maximum participants are joining from Maharashtra, Kerala and Karnataka, however significant increase has been witnessed in participation from Northern Indian states like Uttar Pradesh and Bihar. 4786 participants from Uttar Pradesh, 2554 participants from Bihar have joined the courses. The representation from north eastern states has also improved in the year 2021.

To cater the online training requirements of International users, IIRS has conducted International Distance learning programme under “ISRO-IIRS Space Application Training (ISAT)” programme. A dedicated portal, Learning Management System (LMS) and E-CLASS International platform was utilised for International users. The Massive Open Online Courses (MOOC) under ISAT programme was developed in collaboration with United Nations Office for Outer Space Affairs and the Centre for Space Science and Technology Education for Asia and the Pacific (Affiliated to the United Nations) on “Geospatial Applications for Disaster Risk Management”. The MOOC became very popular among the participants across the globe. Total 7090 participants from have registered for this course in year 2021.

At the end of each course, the participants provides their feedback regarding the course. IIRS E-CLASS platform is having a tool to take feedback of the participants at end of each course. Overall feedback of all the online courses conducted in 2021 is promising and encouraging. The participants found the sessions interesting and indicated that most of their doubts were answered by the faculty during the interactive session. The course content were appreciated by the participants for its depth and range. The session delivery by the experts which included theoretical concepts coupled with practical applications of the technology was highly appreciated. The participants have expressed their interest to participate in similar programmes for various thematic applications.

Overall, the 93% participants has responded that the course objective of the online courses were met to the large extend. It is very encouraging to note that about 96% participants are satisfied with course contents delivered during live sessions. About 87% participants are rating programme organization as “Excellent” to “Very Good”. About 89% participants are satisfied with time assigned for each topic. About 68% participants rate the interaction with faculty as excellent to very good. Due to large number of participants joining the courses, there is also a requirement to further scale up the IT infrastructure for E-CLASS platform.

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## 1. Introduction

The contemporary world is witnessing a revolution in every field including education aided by advancements in Information and communication technology. This has led to various convenient means to help increase the knowledge, education and literacy status of people through the E-learning platforms which provide easy and accessible means for upgrading skills of the learners. Digital learning enables the individual to acquire competencies in relevant areas through a self-paced methods. Though digital learning arrived a bit late in India, it is being embraced enthusiastically and is coming up in a big way. Over the past few years, the government of India through its policy of Digital India, has been promoting such endeavors to popularize digital leaning environment. Learning being the acquisition of knowledge is not dependent on the method of teaching. The focus is on creating environment and providing students an experience that aids their learning by imparting knowledge and developing skills. Distance learning is the process of creating an educational experience of equal qualitative value for the learner to best suit their needs outside the classroom. Over the past few years, the Government of India through its policy of Digital India has been promoting such endeavors to popularize digital learning environment. The distance education methods aims at effective utilization of intellectual resources and ensures the availability of educational material by creation of knowledge pool.

To widen the scope of applications of ISRO's EO missions at grassroots level, capacity-building activity in geospatial technology plays a vital role. IIRS outreach programme is an innovative distance learning initiative for training students and professionals from academia and user departments in the field of geospatial technology & Earth Observation (EO) by utilizing state-of-art Information and communication technology. The programme also attracts young generation to build their career in the area of space science and its applications. IIRS outreach program was initiated in year 2007 with 312 participants from twelve universities in India. Till December 2021, IIRS has successfully conducted **102** outreach programs through live and interactive classroom mode (also known as EDUSAT programme) benefitted more than **4.62 lakh** participants from **3034** network institutes distributed across the country. During last fourteen years, IIRS has successfully established a network of academic and professional Institutions in the country under this programme.

The content of IIRS Distance Learning Program focuses on teaching Basics along with technological advancement in the field of RS, GIS, GNSS and its applications. The sessions

are interactive and majority of such sessions/lectures in DLP courses are delivered by subject experts from IIRS and guest faculty from other ISRO centers.

All the courses are made available through indigenous active learning platform i.e. **Electronic Collaborative Learning and Knowledge Sharing System (E-CLASS)** platform, which enables the participants to attend live sessions, post queries, download study material, attend offline sessions, appear for online examinations and download certificate. E-CLASS is developed by using open source software technology such as Angular, Nodes JS, MySQL, MongoDB, Nginx web servers and open system architecture.

IIRS has strengthened its online learning platform and quickly customized new short term online certificate courses on various topics of geospatial technology and its applications. These courses were made available for wide range of online learners such as students, university faculty, government officials, defense personals, professionals from industry and entrepreneurs. During online courses, the experts from ISRO delivers live & interactive sessions from IIRS studio or his/her office/home. The live sessions are also made available through social media video streaming platform YouTube. IIRS has conducted 30 online courses/workshops during January to December 2021.

This report presents major achievements in online course delivery, details of beneficiaries and technology development by IIRS in online training and education in year 2021.

## **2. Objectives**

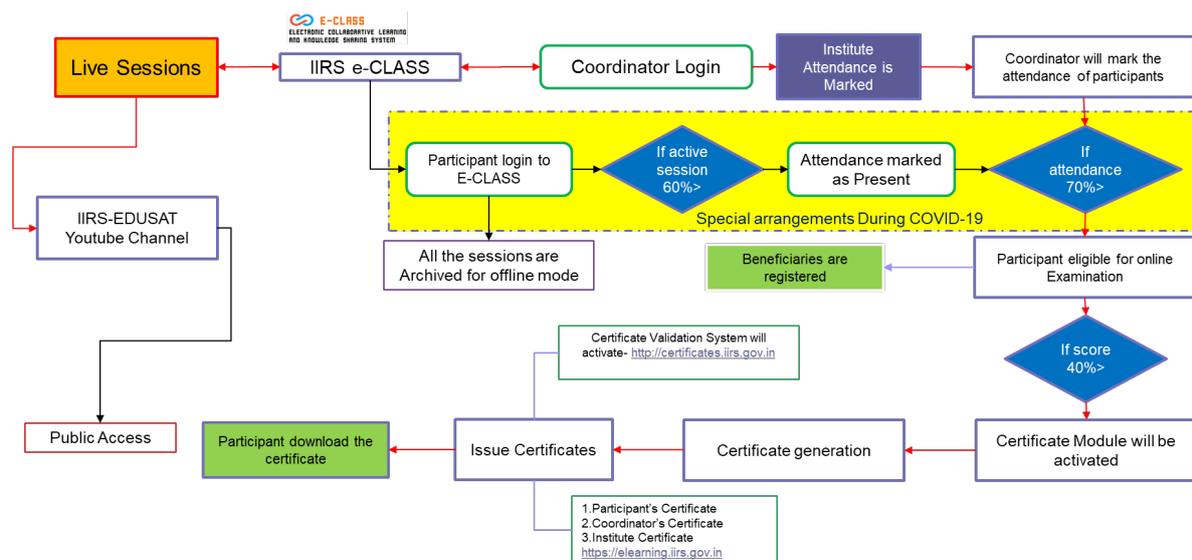
The major objective of IIRS Distance Learning Programme is:

*Mass scale capacity for Enhanced Utilization of Space Technology through Live & Interactive and E-learning/MOOC mode of online training.*

## **3. Live & interactive Mode of online Course Delivery**

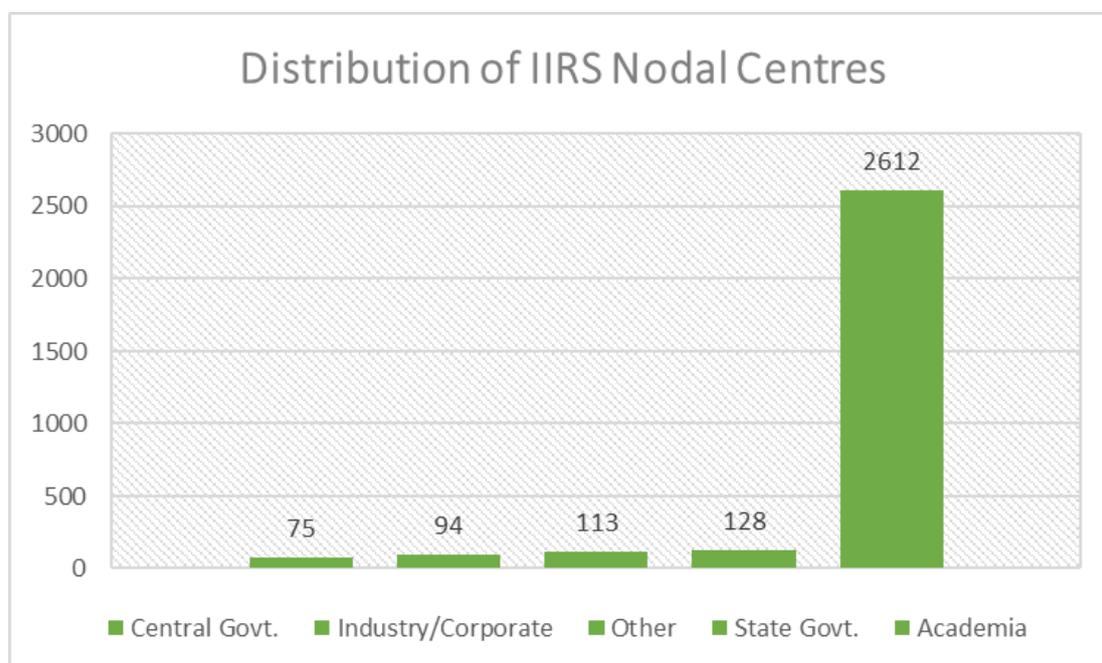
IIRS online courses are an innovative approach for mass scale training and capacity building on geospatial technology and its applications. The present distance learning programme of IIRS is being conducted through following two major modes namely Live and Interactive classroom sessions and E-learning/MOOC based online courses. IIRS Live and Interactive program is most popular among the student community. These courses are conducted through indigenous learning management system "E-CLASS". IIRS live and interactive program endorses blended learning which combines classroom and online learning. The interaction between IIRS and course participant is through live interaction with the participants and also facilitated by the coordinators of the nodal centers.

The complete workflow of Live & Interactive courses of IIRS is shown in Figure 1.

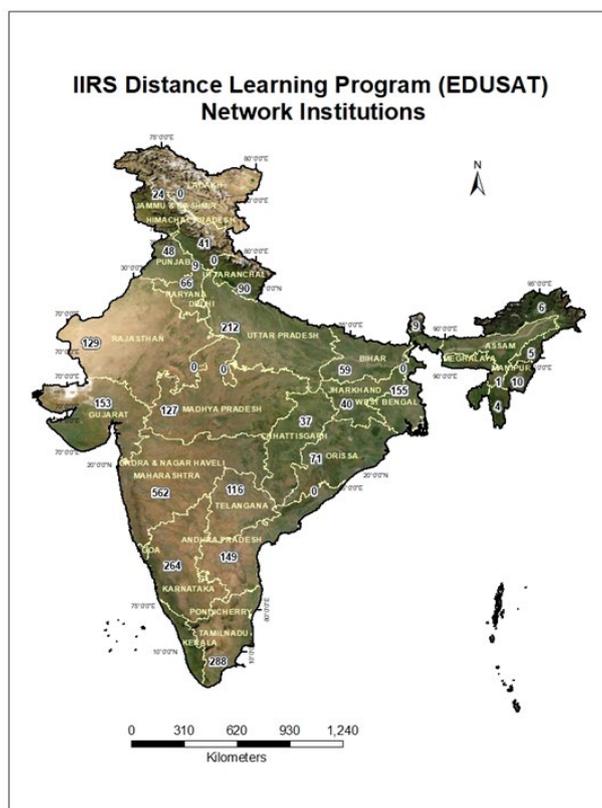


**Figure 1-** Workflow of Live & Interactive online courses of IIRS

Under this mode of online courses, IIRS has setup a network of academic and professional Institutions in India where each network Institute is known as “IIRS Nodal Centre (INC)”. Currently 3034 nodal centers are networked with IIRS. The country wide spatial distribution of these networked Institutions is shown in Figure 3. The participation from different types of Institutions in IIRS outreach programme is shown in Figure 2.



**Figure 2-**Distribution of Institutions networked with IIRS outreach programme



**Figure 3-** Distribution of Network Institutions in India under IIRS DLP

As per the defined Standard Operating Protocol (SOP) of IIRS, one senior faculty or officer is identified as INC coordinator who is responsible for coordination of different online courses conducted by IIRS. These INCs are working together with mutual understanding without any financial engagements. In typical mode of live & interactive courses, the identified coordinator conducts the live classes at his/her Institute and invites interested participants to join the online course in a group. The participants ask his/her doubts to the experts through his/her coordinator. The coordinator act as a moderator for respective INC. The coordinator also submit the daily attendance of the participants through IIRS E-CLASS portal. The participant who attain minimum attendance (typically 70%) are eligible for online examination. The coordinator of IIRS nodal center conducts online examination under his/her supervision. The participants scoring minimum passing grades are eligible for course completion certificate.

During COVID-19 pandemic since March 2020 onward, the participants of IIRS DLP are also allowed to register as an individual participant. In such case, the daily attendance of the participant is now automatically recorded by the system based on their live logs in E-CLASS portal. The participant can interact directly with the presenter during the session through live chat facility available in the portal.

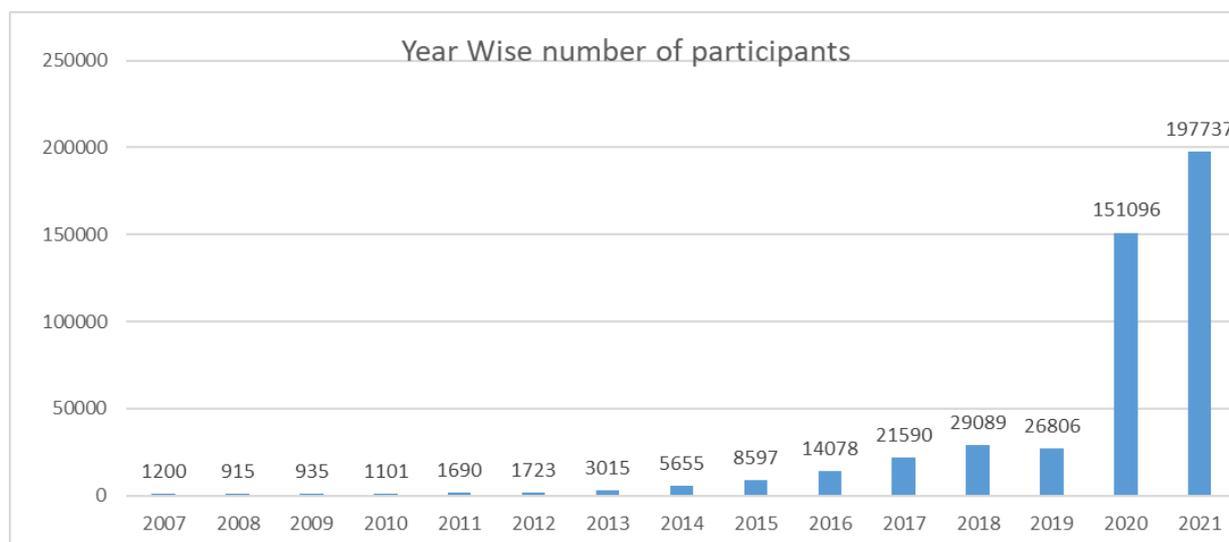
The IIRS outreach programme has emerged as an innovative approach for mass awareness and to train the large number of participants using ICT under distance learning mode. IIRS has successfully established interface for academia and user departments of state and central government using simultaneous live streaming through Internet connectivity. The distance-learning program has reached the unreachable areas and imparted quality training & education in the fields of Remote Sensing, GIS, GNSS and its applications.

Live & Interactive programme of IIRS is most popular among the student community and researchers. IIRS utilizes the Internet facility for conducting live and interactive programme to primarily complement the educational programmes of the Indian Universities/Intutions. IIRS live and interactive program endorses blended learning that combines classroom and online learning. The major objective of this programme is strengthening academia and user segment in space technology & its applications using online learning platforms.

IIRS team has worked towards efficient and effective management of the virtual sessions by adopting best practice measures. Pre session briefing and reminder messages are sent to the participants to ensure smooth conduction and participation. The live classroom sessions are being conducted on daily basis from state-of art studio set up at IIRS. During live sessions, an effort is made to bridge the physical gap between learner and instructor. For this various measures such as attendance monitoring, engaging the participants in class activity through online quiz, providing chat forum for technical discussion, live interaction at end of each session is included as part of the course activity. The concepts are explained through live lectures including suitable illustrations and animations. Theory sessions are complemented with practical demonstrations and hands on exercises. Flexibility of attending sessions in offline mode is provided keeping in mind technical constraints at learner end. IIRS also conducts panel discussion at the end of each course for more involvement of the participants in a course topic by interacting with subject matter expert in a group. To ensure proper assimilation of concepts, at the end of the course, an online examination is also conducted.

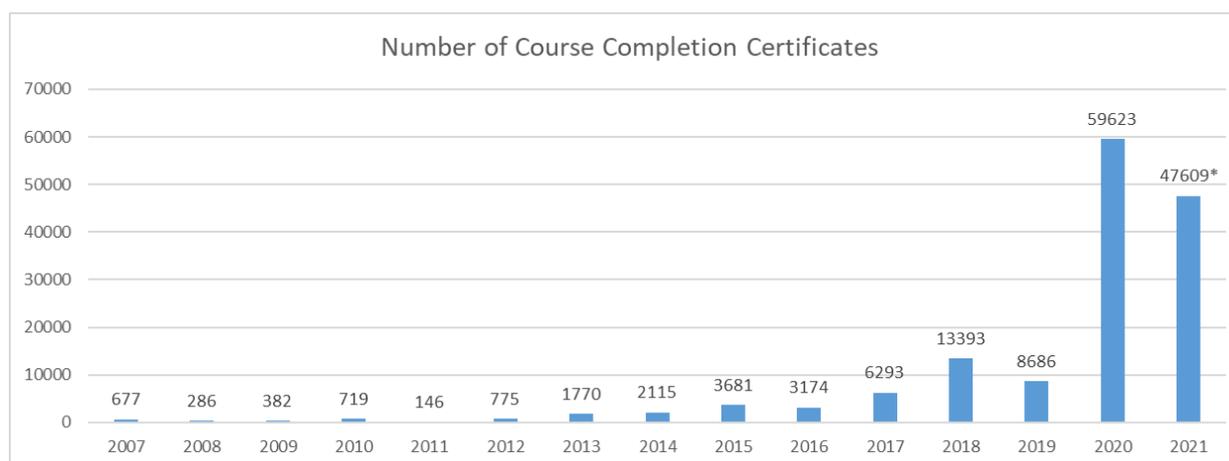
During last fourteen years, IIRS distance learning programme has recorded significant growth in terms of number of participants and number of participating Institutions in the online courses. In the same time, the number courses offered by IIRS has also increased to meet the large user requirements. The year wise distribution of the participants is shown in Figure 4. As shown in Figure 4, the number of participants in IIRS online courses are increasing significantly which shows popularity of these programmes among the learners.

The year 2021 has recorded very high number of participants in these online courses. This growth is due to utilization of lockdown period by IIRS for reaching maximum number participants through its online courses.



**Figure 4-**Year wise growth of the participants in IIRS online courses

The majority of the participants join live sessions to get knowledge on a particular topic. Many of these participants attend only the session (s) on which they have specific interest. However many participants attend the courses systematically to get courses completion certificates. The participants those attain the minimum 70% attendance and score minimum 40% marks in online examinations are awarded with course completion certificate. The online examinations are conducted under supervision of respective coordinator. The year wise distribution of certificates issued under live & interactive courses is shown in Figure 5



\*Certificate generation of 3 courses is in progress

**Figure 5-**Year wise distribution of course completion certificates

## 4. Online Courses conducted in 2021 and Major Achievements

### 4.1 Live & Interactive Courses

While the entire world imposed complete or partial lockdown because of the COVID-19 pandemic, businesses have adapted to work-from-home (WFH) policies with varying degree of success. Education sector has also forcibly undergone a dramatic change, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. In the current scenario IIRS has responded to the present crisis by tapping into its existing Distance Learning Program. During this period, IIRS Distance Learning Program witnessed an exponential growth in terms of number of participants and participating Institutions.

In year 2021, IIRS has conducted total 30 online courses/full day workshops/webinar series benefiting 197737 participants from 1477 networked Institutions. As shown in table 1, in 2021 IIRS has conducted 08 advanced topic courses, 6 basic courses, 6 full day workshops, 3 International webinar series, 5 special courses during COVID-19 lockdown and 2 special customized courses. A total of **1.97 Lakh** participants participated in IIRS online courses in 2021 from **1744** unique institutes across the country. The courses offered were covering a wide range of topics like Basics of Remote Sensing and GIS, Overview of Geoprocessing using Python, Satellite based Navigation: A Journey from GPS to Mobile Phone Platform Geoinformatics for Disaster Management, GIS for Supply Chain Management, Geospatial Technology for Archaeological Studies, Earth Observation for Carbon Cycle Studies, Overview of Web GIS Technology, Machine learning to Deep Learning: A journey for remote sensing data classification, Geospatial technology for hydrological modelling, Geospatial Modelling for Watershed Management, Geo-informatics for Biodiversity Conservation Planning etc. A one-day workshop on Space and Spatial Technology was conducted in Hindi on occasion of "VISHWA HINDI DIWAS". A special course on Fundamentals of Remote Sensing and GIS Technology was also conducted in Hindi language for the benefit of Hindi speaking participants. The summary of different type of courses is shown in Table 1.

**Table 1-** Distribution of different courses and participants in 2021

Type of Course	Number of Participants	Number of Courses
Advance Topic Course	65970	08
Basic Course	37586	06
Full Day Workshop	37119	06
International Webinar Series- WGCapD	5851	03
Special Course During Lockdown	43873	05

Special Customized Course	7338	02
Grand Total	197737	30

In these courses total **272 sessions** were delivered on various aspects of Remote Sensing & GIS technologies and its applications (Table 2). These sessions includes lectures on theory topics and practical demonstrations. All the department of IIRS have contributed in delivering these sessions.

**Table 2-** Number of sessions delivered in different online courses in year 2021

Course ID	Course Name	Name of the Coordinator	Department Name	Start Date	End Date	No. of Sessions
73	Overview of Geoprocessing using Python	Mr. Ravi Bhandari	GIT&DL	18-01-21	29-01-21	9
74	Satellite based Navigation: A Journey from GPS to Mobile Phone Platform	Dr. Anil Kumar	PRSD	01-03-21	12-03-21	9
75	Geoinformatics for Disaster Management	Dr. Arijit Roy	DMS	05-04-21	16-04-21	12
76	GIS for Supply Chain Management	Dr. Sameer Saran	GID	26-04-21	30-04-21	8
77	Geospatial Technology for Archaeological Studies	Dr. Hina pande	PRSD	17-05-21	21-05-21	5
80	Earth Observation for Carbon Cycle Studies	Dr. N.R. Patel	ASD	21-06-21	25-06-21	5
81	Overview of Web GIS Technology	Kamal Pandey	GIT&DL	21-06-21	02-07-21	10
82	Machine learning to Deep Learning: A journey for remote sensing data classification	Dr. Anil Kumar	PRSD	05-07-21	09-07-21	9
83	Geospatial technology for hydrological modelling	Dr. S.P.Agarwal	WRD	19-07-21	30-07-21	9
84	Geospatial Modelling for Watershed Management	Dr. Suresh Kumar	ASD	02-08-21	06-08-21	5
85	Basic of RS GIS & GNSS	Dr. Poonam Seth	GIT&DL	16-08-21	26-11-21	64

Course ID	Course Name	Name of the Coordinator	Department Name	Start Date	End Date	No. of Sessions
86	Remote Sensing & Digital Image Analysis	Ms. Minakshi Kumar	PRSD	16-08-21	10-09-21	18
87	Global Navigation Satellite System	Dr. Ashutosh Bhardwaj	PRSD	13-09-21	24-09-21	8
88	Basics of Geographical Information System	Mr. Prabhakar Alok Verma	GID	27-09-21	22-10-21	17
89	Basics of Geocomputation and Geoweb Services	Mr. Kamal Pandey	GIT&DL	25-10-21	02-11-21	7
90	RS & GIS Applications in Natural Resource Management	Mr. CM Bhatt	DMS	08-11-21	26-11-21	14
91	Fundamentals of Remote Sensing and GIS Technology (Course in Hindi)	Mr. Kamal Pandey	GIT&DL	14-09-21	28-09-21	11
92	Geospatial Inputs for Enabling Master Plan Formulation for AMRUT sub scheme	Mr. Pramod Kumar	URSD	11-10-21	15-10-21	5
93	Geo-informatics for Biodiversity Conservation Planning	Dr. Hitendra Padalia	FED	06-12-21	17-12-21	6
1011	Space Technology and its Applications	Mr. Kamal Pandey	GIT&DL	11-01-21	11-01-21	1
1012	Applications of Satellite Altimetry for Inland Waterbodies	Dr. Praveen Kumar Thakur	WRD	27-10-21	27-10-21	1
1014	Earth Observation based Mapping, Monitoring and Modelling of Landslide: Recent trends and support to early warning system	Dr. Shovan Chatteraj	GSD	21-04-21	21-04-21	1
1015	Remote Sensing for Lunar Science	Dr. Mamta Chauhan	GSD	11-08-21	11-08-21	2
1017	SAR Application for flood hazard mapping and monitoring	Dr. Arijit Roy	DMS	16-07-21	16-07-21	6

Course ID	Course Name	Name of the Coordinator	Department Name	Start Date	End Date	No. of Sessions
1019	Geospatial Modeling Driven Urban Hazard and Risk Analysis	Dr. Pramod Kumar	URSD	21-12-21	21-12-21	7
5005	Image Restoration and Processing of Optical Data	Dr. Manu Mehta	PRSD	16-04-21	07-05-21	4
5006	SAR Data Processing	Mr. Ashish Joshi	PRSD	07-05-21	28-05-21	4
5007	Space based observations for atmospheric hazards	Ms. Pooja Jindal	MASD	25-10-21	29-10-21	5
6001	Space Technology and Applications	Dr. Harish Karnatak	GIT&DL	31-05-21	04-06-21	10
7010	Geo-informatics for field foresters	Dr. C Ramesh	NA	22-02-21	26-02-21	NA
<b>Total Sessions</b>						<b>272</b>

The details of each course topic, course type, duration, number of participating Institutes and participants and number of certificates issued in shown in Table 3.

**Table 3-** Detail of Live & Interactive courses conducted in year 2021

S. No.	Course Name	Course Type	No. of Institutions	No. of Participants	No. of Certificates Issued
1.	Overview of Geoprocessing using Python	Advance	532	10342	2299
2.	Satellite based Navigation: A Journey from GPS to Mobile Phone Platform	Advance	446	8693	2041
3.	Geoinformatics for Disaster Management	Special Course Lockdown	435	9075	2246
4.	GIS for Supply Chain Management	Special Course Lockdown	481	12462	2318
5.	Geospatial Technology for Archaeological Studies	Special Course Lockdown	369	7542	2044
6.	Earth Observation for Carbon Cycle Studies	Special Course Lockdown	408	6089	2218
7.	Overview of Web GIS Technology	Special Course Lockdown	512	8705	2651

S. No.	Course Name	Course Type	No. of Institutions	No. of Participants	No. of Certificates Issued
8.	Machine learning to Deep Learning: A journey for remote sensing data classification	Advance	552	7764	2311
9.	Geospatial technology for hydrological modelling	Advance	539	7134	2227
10.	Geospatial Modelling for Watershed Management	Advance	532	7873	2046
11.	Basic of RS GIS & GNSS	Basic	608	8362	1313
12.	Remote Sensing & Digital Image Analysis	Basic	385	4380	577
13.	Global Navigation Satellite System	Basic	411	4309	397
14.	Basics of Geographical Information System	Basic	429	6537	1048
15.	Basics of Geocomputation and Geoweb Services	Basic	321	9715	964
16.	RS & GIS Applications in Natural Resource Management	Basic	279	4283	821
17.	Fundamentals of Remote Sensing and GIS Technology (Course in Hindi)	Advance	467	7884	1562
18.	Geospatial Inputs for Enabling Master Plan Formulation for AMRUT sub scheme	Advance	283	6492	1397
19.	Geo-informatics for Biodiversity Conservation Planning	Advance	479	9788	3010
20.	Space Technology and its Applications	workshop	398	8810	3175
21.	Applications of Satellite Altimetry for Inland Waterbodies	workshop	448	5155	1000
22.	Earth Observation based Mapping, Monitoring and Modelling of	workshop	176	2501	987

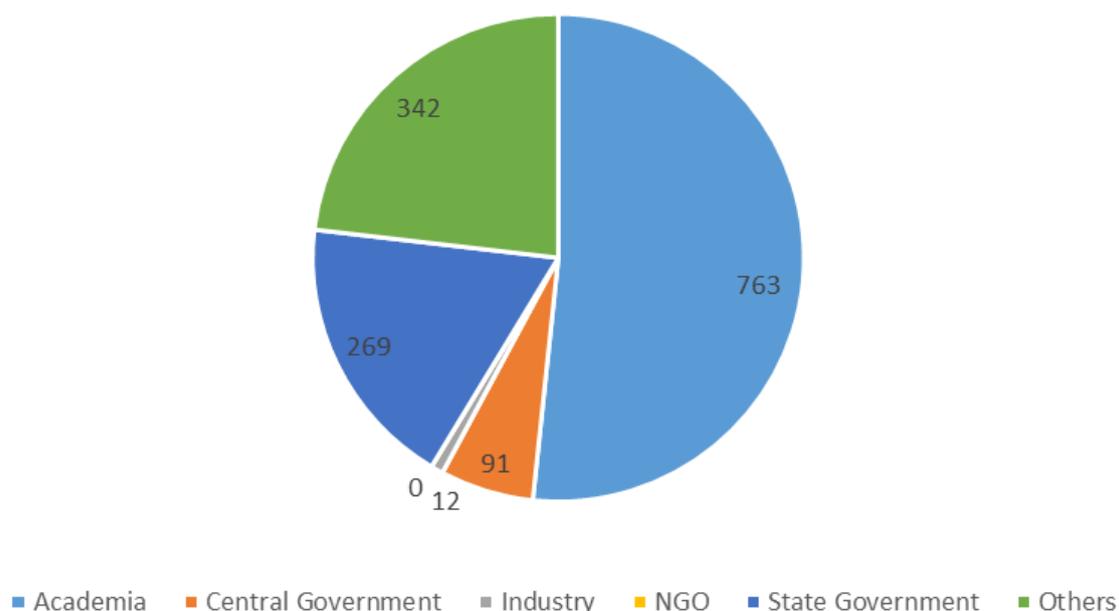
S. No.	Course Name	Course Type	No. of Institutions	No. of Participants	No. of Certificates Issued
	Landslide: Recent trends and support to early warning system				
23.	Remote Sensing for Lunar Science	workshop	631	8642	678
24.	SAR Application for flood hazard mapping and monitoring	workshop	361	5839	2629
25.	Geospatial Modeling Driven Urban Hazard and Risk Analysis	workshop	327	6172	795
26.	Image Restoration and Processing of Optical Data	International Course	21	572	193
27.	SAR Data Processing	International Course	131	4327	1563
28.	Space based observations for atmospheric hazards	International Course	1	952	106
29.	Space Technology and Applications	Special course	1	7250	2993
30.	Geo-informatics for field foresters	Special course	2	88	88

\* The certificate generation of the courses is in progress.

In year 2021 IIRS has recorded maximum number of participants in online courses during last 13 years.

**Total 197737 participants from 1477 Institutions in India participated in 30 online courses conducted by IIRS in year 2021.**

**1477 unique Institutions** joined IIRS Outreach programme in year 2021. The distribution of these Institutions is shown in Figure 6. A total of **348 new institutes** joined IIRS outreach network in year 2021. Table 4 depicts State wise distribution of new Institutions joined IIRS Outreach network in 2021.



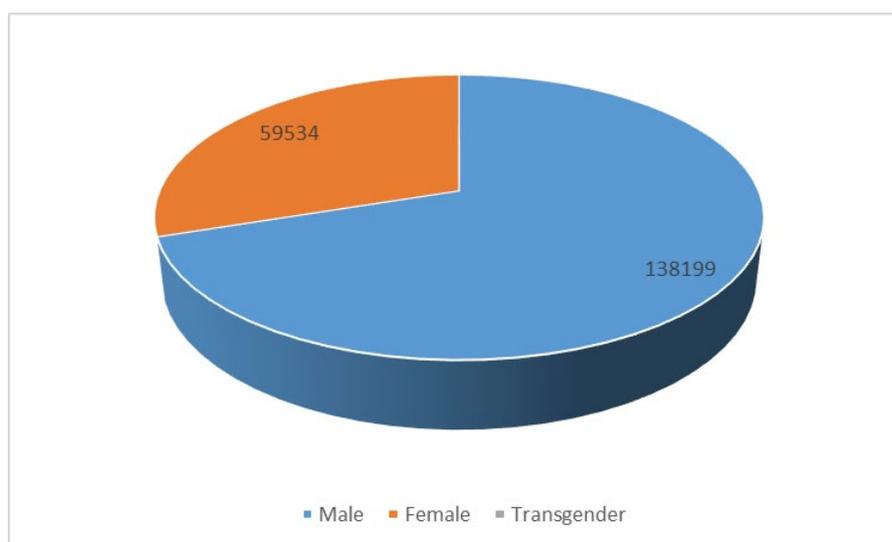
**Figure 6** -Distribution of unique Institutions participating in IIRS Outreach network in year 2021

**Table 4-** State wise distribution of new Institutions joined IIRS Outreach network in 2021

State	Number of New Institutions
Andhra Pradesh	16
Arunachal Pradesh	1
Assam	11
Bihar	8
Chandigarh	0
Chhattisgarh	2
Delhi	11
Goa	1
Gujarat	13
Haryana	6
Himachal Pradesh	7
Jammu and Kashmir	1
Jharkhand	4
Karnataka	33
Kerala	18
Madhya Pradesh	8
Maharashtra	74
Manipur	3
Meghalaya	0
Mizoram	0
Nagaland	1
Odisha	10
Pondicherry	2
Punjab	3

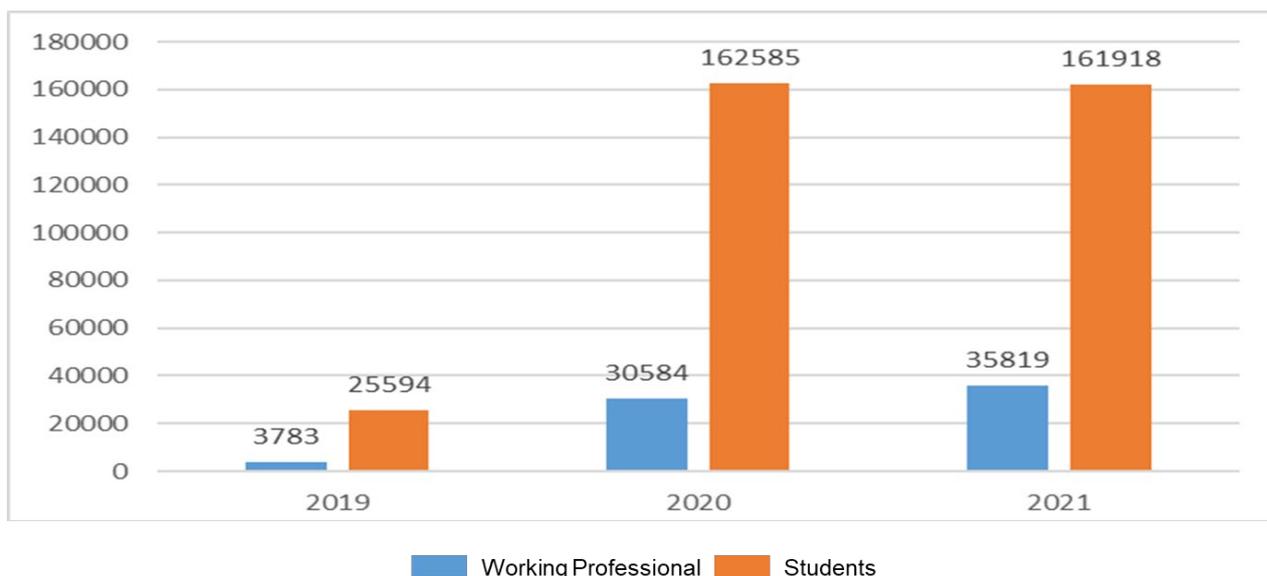
State	Number of New Institutions
Rajasthan	13
Sikkim	0
Tamil Nadu	37
Telangana	15
Tripura	1
Uttar Pradesh	22
Uttarakhand	8
West Bengal	19
<b>Total</b>	<b>348</b>

To get a clear picture of growth in participation, data for year 2021 was analysed. Out of total 1,97,737 participants, 138199 were male and 59,534 were female. A total of 04 participants marked their category as transgender. The gender wise distribution of the participants in live & interactive courses in year 2021 is shown in Figure 7.



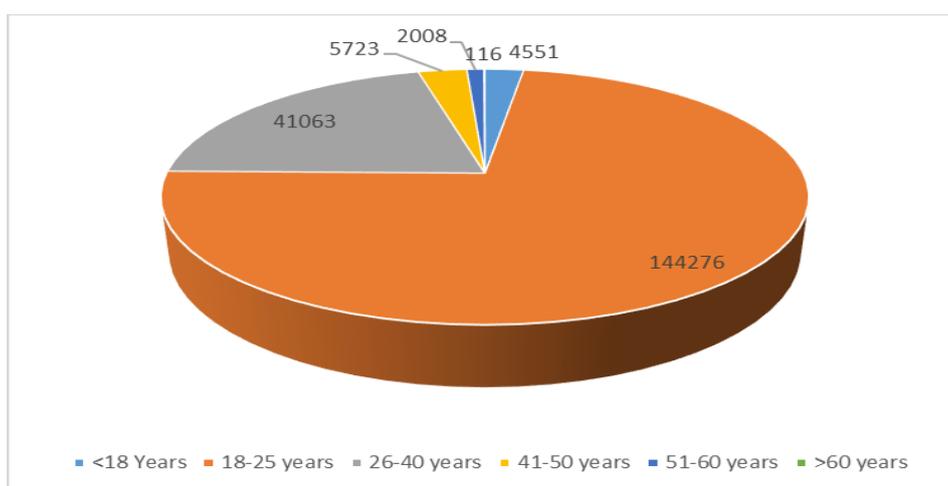
**Figure 7-Gender wise distribution of the participants in year 2021**

Even though IIRS Distance Learning Program started with an objective of complementing Indian University education, over the years it has witnessed increased participation from professionals working in the area of Remote Sensing and GIS. In the year 2021, 35819 professionals joined the courses compared to 30584 in 2020. The increase in the participation of professionals is around 17% for year 2021. Figure 8 depicts a comparative analysis of number of students and professionals.



**Figure 8-** Year wise distribution of the participants

The participant’s data in terms of their age group was also analysed. Interestingly it was noted that the participants of all age group are participating in online courses of IIRS. It was observed that the maximum participation was in the age group 18-25. Most of undergraduate and post graduate students are in this category. Around 41063 participants including students and professionals of age between 26 to 40 years have joined IIRS online courses in year 2021. About 4551 participants who are less than 18 years of age have attended IIRS DLP courses. It was encouraging to note that around 116 senior citizens have also shown interest in IIRS DLP courses. The age group wise summary of the participant is shown below in Figure 9:



**Figure 9-** Age wise distribution of the participants in year 2021

As per the data, about 72% participants are from 18-25 year age group and about 20% participants are from 26-40 year age group.

Further, the data was also analysed for state wise participation in IIRS online courses. Over the years it has been observed that the participation is maximum for South and central Indian states. The data for year 2021 depicts that even though maximum participants are joining from Maharashtra, Kerala, Karnataka, Tamil Nadu and Andhra Pradesh, however significant increase has been witnessed in participation from North Indian states like Uttar Pradesh and Bihar. Table 5 shows the state wise beneficiaries of IIRS online courses in year 2021.

**Table 5-** State wise distribution of the beneficiaries in 2021

State	No. of Participants
Andaman and Nicobar Islands	3108
Andhra Pradesh	12062
Arunachal Pradesh	191
Assam	2853
Bihar	9587
Chandigarh	387
Chhattisgarh	2324
Dadra and Nagar Haveli	56
Daman and Diu	39
Delhi	6707
Goa	392
Gujarat	8883
Haryana	4751
Himachal Pradesh	1479
Jammu and Kashmir	2122
Jharkhand	4133
Karnataka	12791
Kerala	8637
Lakshadweep Islands	17
Madhya Pradesh	7741
Maharashtra	31811
Manipur	323
Meghalaya	327
Mizoram	66
Nagaland	139
Odisha	5600
Pondicherry	587
Punjab	2064
Rajasthan	6464
Sikkim	139
Tamil Nadu	13498
Telangana	10915
Tripura	450
Union Territory	1

State	No. of Participants
Uttar Pradesh	20247
Uttarakhand	3147
West Bengal	12250
International	1449
<b>Total</b>	<b>197737</b>

## 4.2 E-learning courses

To enhance the outreach of geo-spatial science and technology, IIRS has also developed e-learning contents and Learning Management Systems (LMS) for different certificate courses in Remote Sensing and geo-spatial technology and its applications. E-learning is an active learning platform which provides learner centric online courses to the online learners. It provides a platform where the individual gets a customized package related to key thematic areas, through a computer-guided process. The learning is made available through interactive 2D and 3D animations, audio, video for practical demonstrations, software operations with free and open data sources. The e-learning contents are created as an interactive multimedia application and integrated with customized LMS using open source Moodle platform. The most attractive part of these online courses are “*learning anytime from anywhere*”. The learners can join these course any time and can complete the course with self-pace.

Till December 2020, IIRS was conducting five E-Learning courses on various technological aspects of remote sensing, GIS and GNSS technology and its applications. In year 2021, the initiatives were taken to upgrade the contents of these courses with inclusion of new e-learning courses on thematic domains. Currently, more than 29,000 participants have registered for these courses out of which 4178 participants have opted for certificate until December 2021. The courses contents of RS&GIS technology are also available in Hindi language.

IIRS eLearning course “Comprehensive course on Remote Sensing and GIS” was approved by All India Council for Technical Education (AICTE) as a 04 credit course and made available on SWAYAM portal of MHRD. In the **year 2021, around 23,000 participants** were registered for the course through SWAYAM portal. The examination was conducted by National Testing Agency and around 500 participants successfully completed the course and received certificate from AICTE.

To expand the scope of E-Learning from technology to application of technology in thematic disciplines, e-Learning content for eight thematic disciplines demonstrating applications of geospatial technology were prepared. A total of 30.25-hours content covering RS and GIS applications in various disciplines such as urban and regional studies, agriculture, disaster mitigation and management, forestry, water resources and marine sciences were generated.

The developed thematic contents are being organized in form of e-Learning courses and will be made available to the learners in year 2022 through IIRS e-learning portal. A total of 11 courses on advanced topics such as Remote Sensing Application in Agriculture Sciences, Remote Sensing and GIS for Urban Environment and Modeling, Remote Sensing Applications for Forest and Ecological Studies, Remote Sensing Application to Ocean Science, Satellite Meteorology and its Applications, Remote Sensing Application to Coastal Zone Management and Air Pollution studies using Earth Observation data are ready and will be soon available to users. The details of the new courses developed under self-paced learning is given in Table 6.

**Table 6: Self-Paced courses developed by IIRS**

<b>S. No.</b>	<b>Course Title</b>	<b>Duration</b>
1	Basics of Remote Sensing, GIS and GNSS	61 Hrs
2	Remote Sensing Application in Agriculture Sciences	13.75 Hrs
3	Remote Sensing Application to Disaster Management	12.66 Hrs
4	Remote Sensing Applications for Forest Studies	8.41 Hrs
5	Remote Sensing Applications for Geological studies	7.5 Hrs
6	Remote Sensing Application to Ocean Science	4.76 Hrs
7	Satellite Meteorology and its Applications	3.3 Hrs
8	Remote Sensing Application to Coastal Zone Management	4.35 Hrs
9	Air Pollution studies using Earth Observation data	4.9 Hrs
10	Remote Sensing and GIS for Urban Environment and Modeling	29.66 Hrs
11	Remote Sensing Applications for Water Resource studies	7.81 Hrs

### 4.3 International Online Training Programme

Indian Space Research Organisation (ISRO) is developing many space programmes for scientific and societal applications. The target beneficiaries of Indian space programme varies from group of users from an organization to national, regional and global users. The data and information services for various governmental organizations are increasing with very fast pace.

The ongoing outreach programme of IIRS-ISRO is targeted to the users from India. However there are many requests from outside India to participate in IIRS-ISRO online courses. In the recent past, IIRS has conducted few online courses for International users under Working Group on Capacity Building and Data Democracy (WGCapD) of Committee on Earth Observation System (CEOS). The response received from International users on these programme was quite overwhelming. Moreover IIRS also hosts the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) and the participants from Asia Pacific regions has shown their keen interest in the online courses conducted by IIRS-ISRO.

By considering the online training requirements of International users, IIRS has announced International Distance learning programme under “**ISRO-IIRS Space Application Training (ISAT)**” programme in year 2020. A dedicated portal, Learning Management System (LMS) and E-CLASS International platform was developed and deployed for International users in the Month of October 2020. This was an initiative to extend the IIRS Outreach programme for International users for effective utilization of Remote Sensing and Geospatial Technologies for different level of user segments. This online training programme focusses on:

- Remote Sensing and Geospatial Technology and its applications;
- Satellite Navigation technology and Its applications;
- Planetary Science and applications;
- Weather and climate studies with focus on spatial data analytics and assimilations.

The main focus of the programme is to popularize the technology, data products and services from Indian space programme.

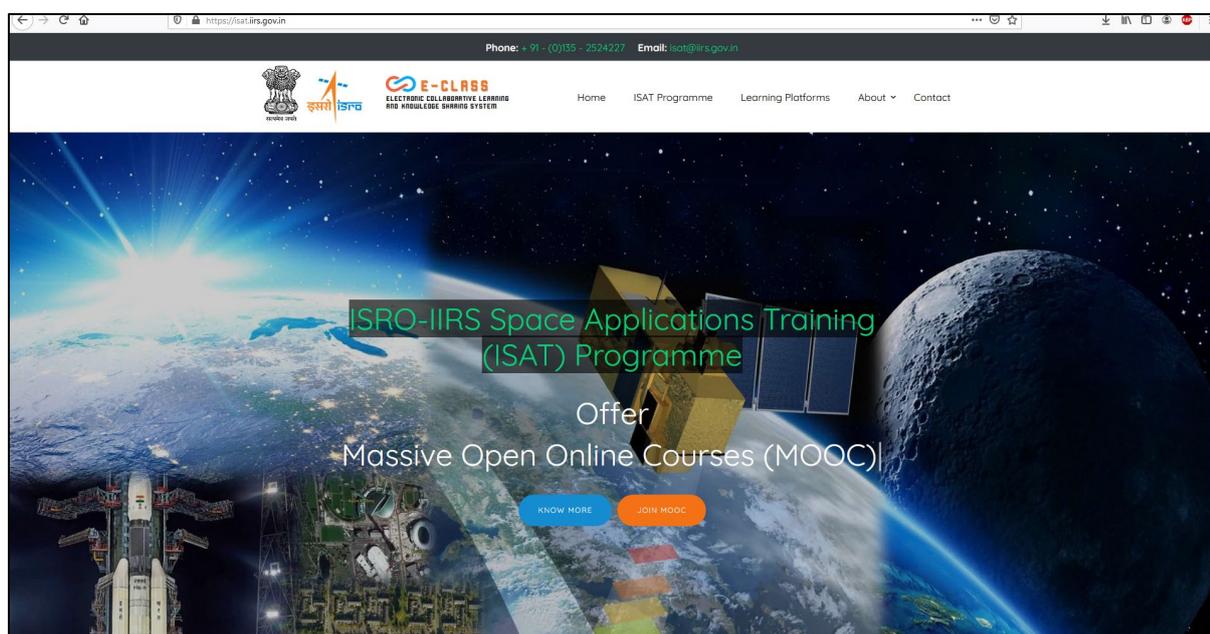
In the International Outreach Programme following target users are identified:

- Student community- Undergraduate, Post graduate and PhD scholars;
- Scientist and Researchers; and
- Governmental users from SAARC and Asia Pacific countries.

The Massive Open Online Courses (MOOC) under ISAT programme was developed in collaboration with United Nations Office for Outer Space Affairs and the Centre for Space Science and Technology Education for Asia and the Pacific (Affiliated to the United Nations) on “Geospatial Applications for Disaster Risk Management”. This MOOC was a free and flexible online training programme available to everyone who wants to enhance their capabilities related to the use of geospatial and Earth observation technologies in disaster risk management.

During the challenging times of the COVID-19 outbreak, MOOCs are an effective way of reaching a large number of participants to share knowledge. This course aims to strengthen efforts of disaster management professionals to contribute to achieving the targets of the Sendai Framework for Disaster Risk Reduction 2015-2030, the 2030 Agenda for Sustainable Development and the Paris Agreement stemming from the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change.

IIRS has developed online learning platforms and LMS for ISAT programme and made available to the learners through URL- <https://isat.iirs.gov.in>



**Figure 10-** Home page of ISAT web portal- <https://isat.iirs.gov.in>

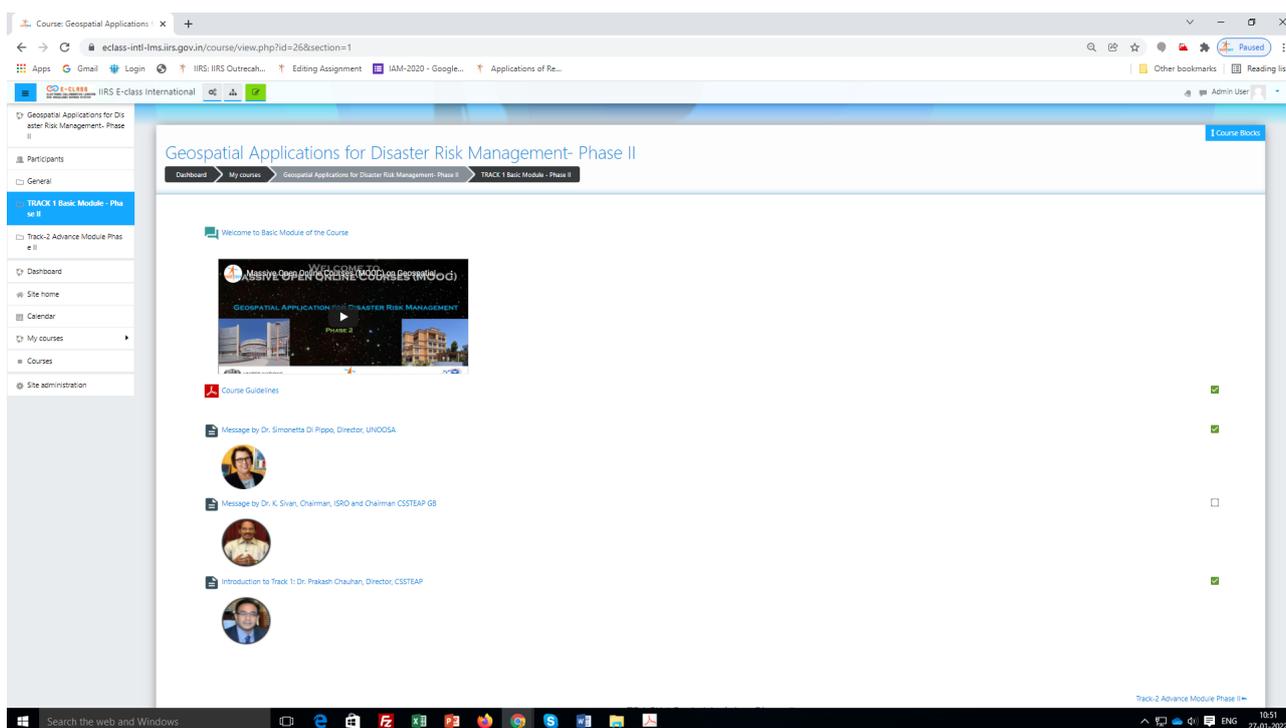
The Phase-2 MOOC under ISAT portal was launched on June 1<sup>st</sup>, 2021. The inaugural session was attended by professionals from UN-OOSA, CSSTEAP, ISRO HQ, and IIRS (Figure 12).



*Figure 11- Inaugural session of ISAT programme*

The MOOC became very popular among the participants. Total 7090 participants from 127 countries have registered for the course. Summary of the participants of MOOC is shown in table 7. The Learning Management System (LMS) of MOOC was developed by open source software technology using MOODLE platform (Figure 12). This online courses consists of 24 Sessions by 20 Speakers from 14 Organizations. The list of organization those delivered the sessions in this MOOC are:

- United Nations Office for Outer Space Affairs, Austria
- Centre for Space Science and Technology Education for Asia and the Pacific (Affiliated to the United Nations), India
- United Nations Economic and Social Commission for Asia and the Pacific
- Delta State University, United States of America
- Bonn University, Germany
- Joint Research Centre, European Commission
- University of Salzburg, Austria
- International Water Management Institute, Sri Lanka
- Indian Space Research Organisation, India
- Central Building Research Institute, India
- Maxar Technologies, Singapore

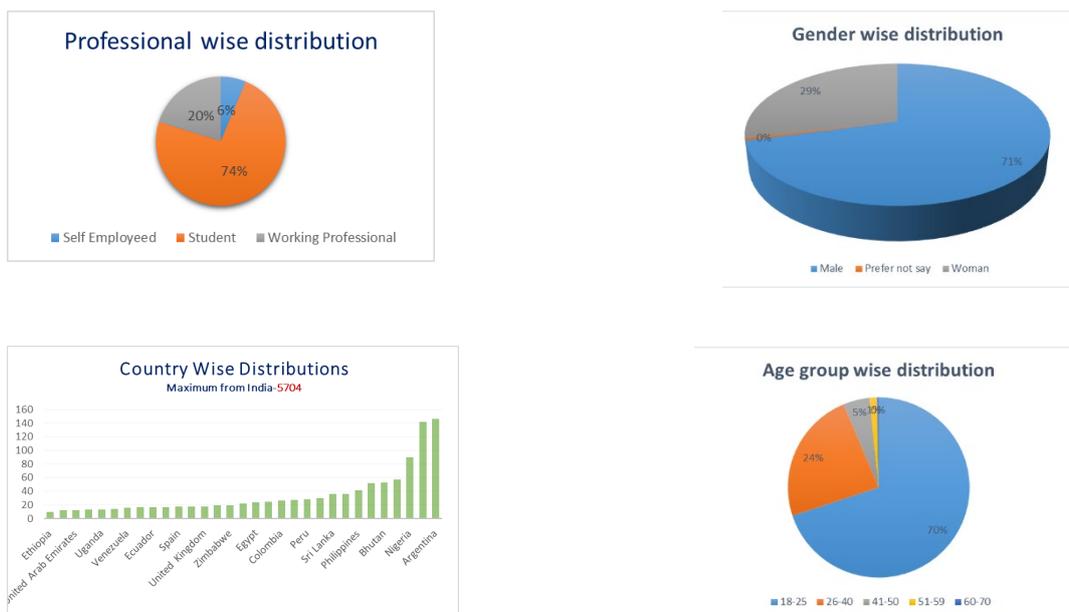


**Figure 12- LMS Dashboard of MOOC**

**Table 7- Summary of the participants of MOOC (Till December 2021)**

Total Registrations	7090
Participants from India	5704
Participants from Outside India	1386
No. of Countries	127
No. of participants completed Track 1	1040
No. of Participants Completed Track 2	644
Feedback submitted Track 1	1667
Feedback Submitted Track 2	614

The MOOC was targeted towards Government officials and professionals, educators, university students and other stakeholders working in the field of disaster management. The MOOC was structured in two tracks. Track 1 constituted of Basic Module aimed at enhancing awareness of the latest trends in Disaster Risk management. The track 2 focused on sharpening skills in use of geospatial and Earth Observation technologies in all phases of disaster management. The distribution of the participant of the MOOC is shown in Figure 13.



Graph shows other than India and countries having participants more than 15

**Figure 13-** Distribution of the participant in ISAT MOOC in 2021



**Figure 14-** Director UNOOSA and Chairman ISRO is delivering the session in MOOC

The MOOC based approach for mass scale capacity building and skill development has emerged as an innovative approach in online course delivery. The participants from different educational and social background are learning the technology in collaborative mode. It is also a global approach for knowledge sharing. The joint effort of IIRS, CSSTEAP and UNOOSA was very successful in this direction. The Learning Management System (LMS) and E-CLASS platforms are very effective to achieve the objectives of the course.

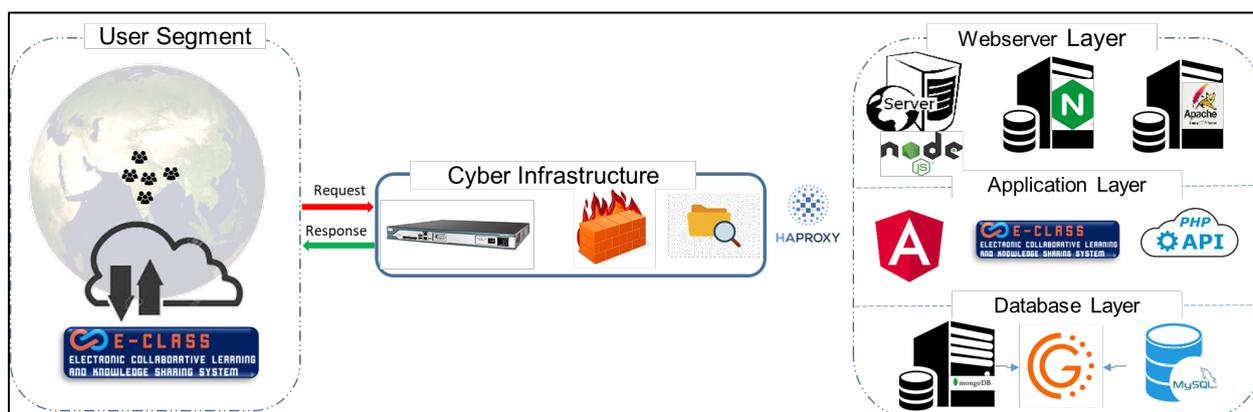
## 5. Technology Development for Digital learning

### 5.1 E-CLASS Portal:

IIRS has designed and developed Electronic Collaborative Learning and Knowledge Sharing System (E-CLASS) for online training and education under its Outreach programme. The E-CLASS platform provides various innovative tools for learners such as Active Learning Mobile App for attention grabbing of online learners, live streaming of sessions, monitoring of class and student activities, automated attendance recording system, teacher's dashboard, session archives for offline learning, conduction of online examination and sharing of learning resources etc. The E-CLASS platform is also customized and implemented for conduction of webinar series under CEOS- WGCapD activities.

#### 5.1.1 System Architecture

E-class platform has been designed and developed as a multitier architecture (Figure-15) with the three major segments: viz. User, Cyber and Application.



*Figure 15- System Architecture of E-CLASS platform*

- a) **User Segment:** The system has been designed in such a way that it can be accessed via any client device i.e. desktop, laptop or mobile device. The system is independent of the Operating System as well and is accessible in all major operating systems such as Windows, Android, Linux, iOS etc. Apart from device and OS compatibility, the system is compatible with all major web browser applications. It can be accessed via browser only, without any requirement of plugin or application installation in client device. The system has been deployed with the SHA256 G2 SSL security certificate and is fit well under the safe browser applications. The accessibility mechanism at

the user end is very simple, the flow is given below. The users are allowed to access via http protocol only.

**Step 1:** User access the system with the URL: <https://eclass.iirs.gov.in> using any browser in a computing device.

**Step 2:** The user has to register for a course via a nodal center which are registered under IIRS Distance Learning Program. The registered and approved users are provided the login credentials for the specific course. The user can register for the webinar as well from this interface.

The screenshot shows the 'Participant Registration' form on the elearning.iirs.gov.in website. The form is divided into several sections: 'Course Details', 'Personal Information', and 'Address Details'. The 'Course Details' section includes a dropdown menu for 'Select Course Name' and a list of institutions. The 'Personal Information' section includes fields for 'Salutation', 'Full Name', 'Name in Hindi', 'Father's Name', 'Date of Birth', 'Gender', 'Nationality', 'E-mail', 'Confirm E-mail', and 'Mobile Number'. The 'Address Details' section includes a field for 'Correspondence Address'. The form also includes a 'Deny Institute' button and a 'Please use UNICODE for typing in Hindi' note.

**Figure 16- Learner's Registration Interface**

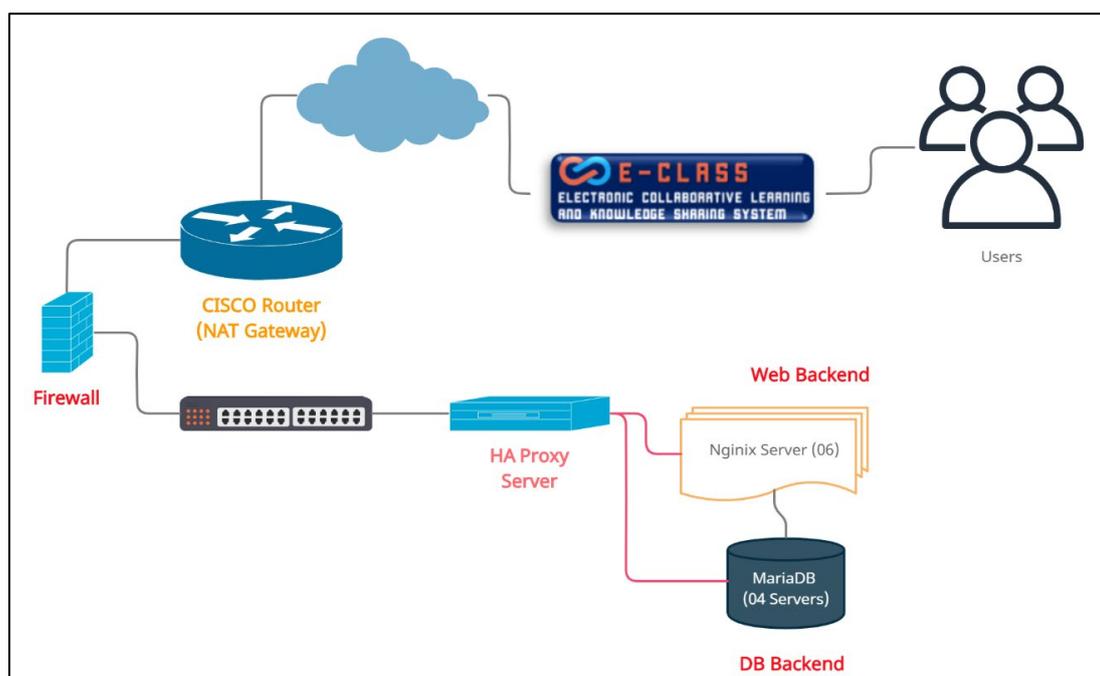
**Step 3:** Once login in the user get access to the online class along with other resources (Figure 17)

The screenshot shows the E-CLASS user interface. The page is titled 'E-CLASS' and includes a sidebar with navigation options: 'Notice Board', 'Live Session', 'Offline Session', 'Study Material', 'Quiz', 'Question', 'Online Users', 'Reports', and 'Chat History'. The main content area displays 'Latest News & Announcements' with a list of announcements. The first announcement is dated 'Mar 7, 2022' and is titled 'Schedule of 96th IIRS Outreach Programme on "Hyperspectral and Microwave Remote Sensing Techniques for Geological Studies"'. The second announcement is dated 'Jan 1, 2022' and is titled 'Course Procedure Demo Video'. An 'Archive' button is visible at the bottom right.

**Figure 17- Online lecture and other resources access to the user**

## b) Cyber Infrastructure Segment

The system has been designed to meet all the cyber security requirements as per Government of India guidelines. It has been hosted under secure cyber security infrastructure. All the users request and responses are routed via firewall with up-to-date security definitions. The request from the internet user lands at Router and then goes to the firewall where it is accessed for possible security threats. Once cleared the request is passed on to the application Cluster Gateway.



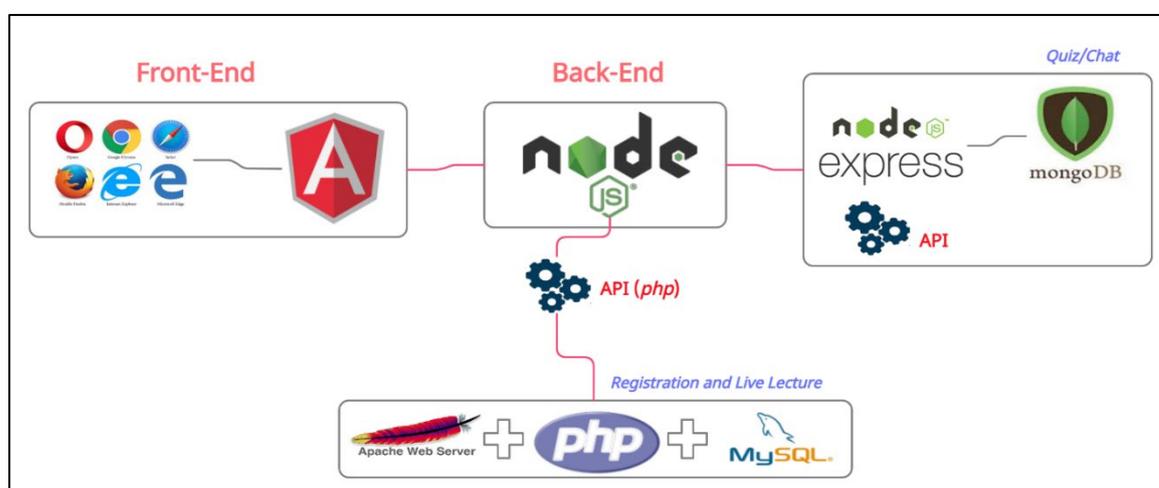
*Figure 18- Cyber Infrastructure of E-CLASS*

HAProxy has been configured at the Application Gateway for Load Balancing (LB) and ensuring High Availability (HA) of the software application. HAProxy is an open source de-facto standard for LB and HA. Its mode of operation makes its integration into existing architectures very easy and riskless, while still offering the possibility not to expose fragile web servers to the net (Figure 18). The current setup consists of 06 Nginix Server and 04 Maria DB Servers and it is capable of handling 10,000 concurrent users at a time with negligible time delay. Currently virtual servers are integrated in the system. This setup is scalable and be scaled to meet further requirement as well.

## c) Application Segment

The application segment consist of the E-CLASS application which has been developed using a stack of state-of-the-art technologies. The front-end request is received through Angular JS, which is a powerful JavaScript framework for the

development of interactive web applications. The user requests are handled by the NodeJS, which is an asynchronous non-blocking, event-driven JavaScript runtime designed to build scalable network applications. It is used for both front-end as well as back-end web application development. In the present architecture an additional framework of NodeJS viz. Express JS has been utilized for handling database request/response. ExpressJS passes the MongoDB database receives the response which forward it back to the user in the Angular frontend. The complete application architecture is a hybrid in nature and follows MEAN architecture integrated with PHP Apache MySQL technology. The apache component is used for the live lecture whereas the Express Component is used for the Quiz and Chat Applications (Figure 19)



*Figure 19- Technology stack of E-CLASS software application*

## 5.2 Innovative online learning tools

The E-CLASS application cater to the requirement of the huge number of participant in the online education program of IIRS. The application is a complete end-to-end solution for conduction of online courses. The solution provides mechanisms for various activities like course announcement, student registration, nodal center registration, approval of student application, auto generation of login credentials for the learners, participation in lectures (live as well as offline), attendance monitoring and recording, live quiz conduction as class activity during the live session, conduction of online examinations, shortlisting of students for certificate, certificate generation and certificate download by the student and coordinator. The major modules are described below.

### 5.3 Reception of live programme

The live lectures are made available to the participants via the E-CLASS platform with all security mechanism in place. In order to enhance the performance of the quality the lectures are streamed via through YouTube as well. The attendance is marked automatically based upon the duration spent in attending the live lecture.

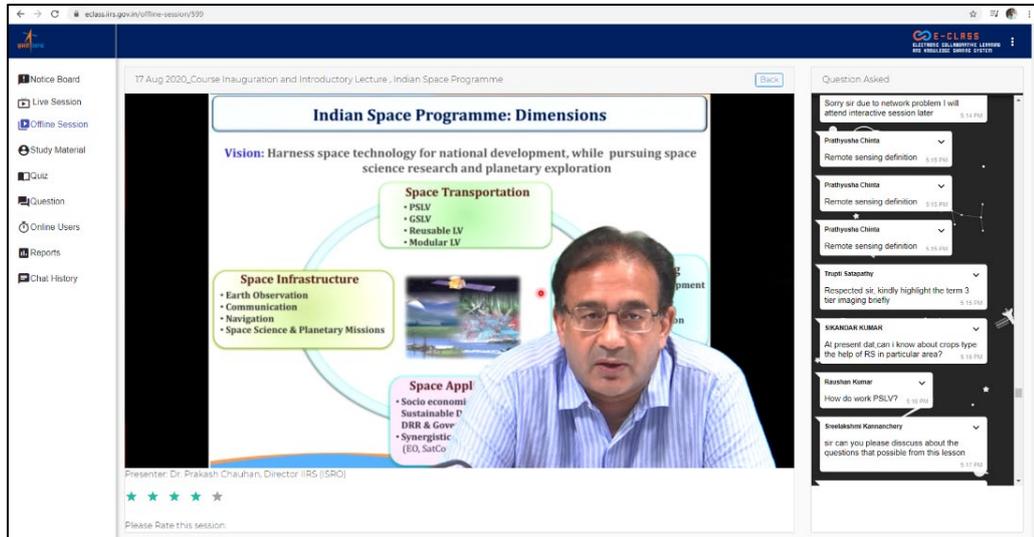


Figure 20- Reception of live lecture through E-CLASS platform

- Interaction module- Chat message mode

The participants are allowed to interact with the management for course relate queries through online chat box (Figure 21.). At the same time the participants can also interact with the teacher for technical queries. This module has been developed using the Express framework of NodeJS within the MongoDB database.

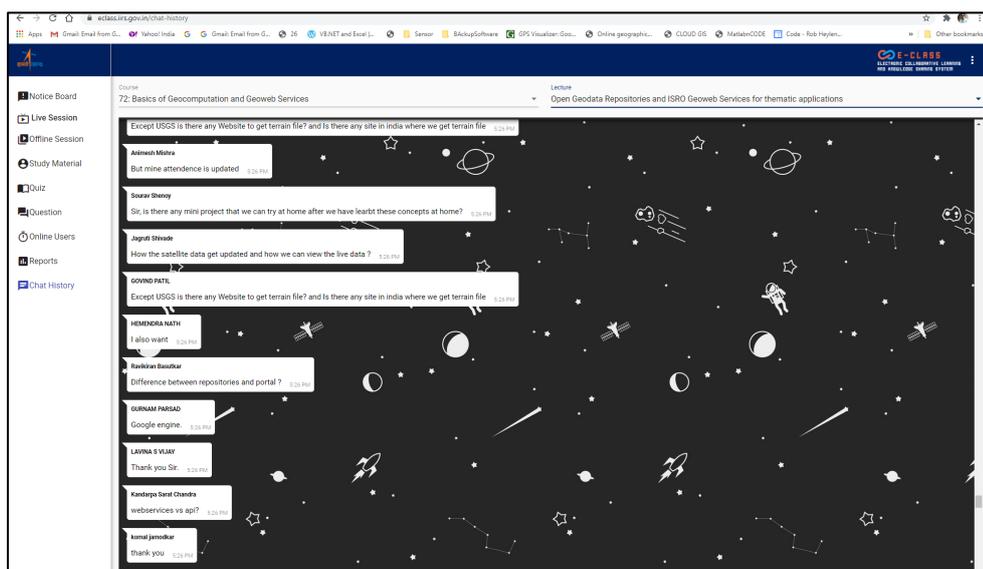


Figure 21- Lecture/Course specific Chat box interface for queries

## 5.4 Online registrations of Institutions

Indigenous module has been developed for the registration of the institutions for IIRS distance learning program. The mechanism of nodal institutes have been put in place in order to decentralize moderation of students registration, it allows the distributed management of course participants. The coordinator at the registered institute are assigned the responsibility of students coordination for their institute viz. approval of the students application while verifying the online document submitted by the student, verifying and marking the attendance of the students, allowing the students to appear for the exam and approving the certificate of participation for the student. The coordinator dispense all of these responsibilities through automated online system available in the E-CALSS. The online registration of the institutes being with the filling of an online form (Figure 22) available at <https://elearning.iirs.gov.in/edusatregistration/coordinator>, the coordinator from the requesting institute is required to submit (online) a letter of nomination from the competition authority of his/her institute. Guidelines to fill the form are also available at <https://elearning.iirs.gov.in/edusatregistration/coordinatorInstructions>. The template nomination form is available at the below link, which need to be vetted by the head of the institute [https://elearning.iirs.gov.in/edusatregistration/documents/willingness\\_letter.pdf](https://elearning.iirs.gov.in/edusatregistration/documents/willingness_letter.pdf). Once the duly completed form is submitted online then an online module is available from where the focal point at IIRS can review the form and take decision for approval. Upon approval the name of the institute get populated in the list of approved institutes in the course application form.

The screenshot shows a web browser window displaying the 'Coordinator Registration' form. The form is titled 'Coordinator Registration' and has a red notification bar that says 'Please use UNICODE for typing in Hindi | हिंदी में टाइपिंग के लिए यूनिकोड का प्रयोग करें'. The form is divided into three main sections: 'Mandatory Fields', 'ORGANISATION DETAILS', and 'PERSONAL DETAILS'. The 'Mandatory Fields' section includes radio buttons for 'University/Institute/College', 'Central Govt./Ministry/Department', 'State Govt./Ministry/Department', 'Industry/Corporate', and 'Other'. The 'ORGANISATION DETAILS' section includes fields for 'Name of the Organization (in English)', 'Name of the Organization (in Hindi)', 'Department', 'Country', 'State', 'City', 'Pin Code', and 'Address'. The 'PERSONAL DETAILS' section is partially visible at the bottom.

Figure 22- Online application form registration of institute for IIRS DLP program

- **Approval and registrations of Institutions**

The online application received from the requesting institutes is scrutinized via online module for meeting all the desired requirements, once find okay, an automated message is sent to institute and the institute's name is populated in the approved institutes list available online. The entire process is automated in the online module and is completed without any time delay.

- **Creation of coordinator's Login in LMS and E-CLASS**

Upon successful registration of the institution, the login credentials are generated and sent automatically to the registered coordinator. The coordinator is provided with a dedicated dashboard (Figure 23) for student coordination. Various management tools such as view details of the student, approve the student, mark the attendance, and check the Attendance status of individual student, status of examination and certificates.

S.No.	RegNo.	Name	DOB	Mobile No.	Email	ID_Proof	Status
1	2020710561237	RAJAKUMARI P	12-01-2001	8489477327	rajakumaripandiyani2@gmail.com	View	Approved Disapprove
2	2020710561977	CHANDRA SETHI	19-11-1991	9036060410	pntpuri@gmail.com	View	Approved Disapprove
3	2020710562349	EKTA AGGARWAL	05-01-1995	9278617636	ektaagg05@gmail.com	View	Approved Disapprove
4	2020710562529	Pavan Kushwaha	02-07-1999	9691619965	kushwahapavan615@gmail.com	View	Approved Disapprove
5	2020710562845	Himanshu Singla	04-02-1996	9992017935	himanshusingla7690@gmail.com	View	Approved Disapprove
6	2020710563305	SUSAVAN SANA	26-09-2000	9733419182	sanasusavan6@gmail.com	View	Approved Disapprove
7	2020710563457	Merlin Nadar	25-11-1999	8108699586	merlinmary112@gmail.com	View	Approved Disapprove
8	2020710563469	SAUNAVAMANNA@YMAIL.COM MANNA	01-06-1991	8371889147	saunavamanna@ymail.com	View	Approved Disapprove
9	2020710564845	Aniket Aman	12-06-2001	8084883387	pardezi256@gmail.com	View	Approved Disapprove
10	2020710565953	SHARVARI DIXIT	11-02-1999	7498496799	sharvardixit11@gmail.com	View	Approved Disapprove

**Figure 23- Coordinators Dashboard**

- **Participants Management System**

The following sub modules are available for the coordinator in the coordinator's dashboard in E-CALSS platform.

- Documents verifications,
- Participant approval,
- Attendance submission,
- Coordinator and participant's profile updation
- View List of courses (Live/Past/Future)

## 5.5 Generation of Digital certificates.

The application on successful completion of the course and meeting the criteria of attendance and exam get the digital certificate. The certificate is digitally signed and can be verified through QR Code, which is printed in the certificate itself (Figure 24).

The screenshot shows the IIRS LMS interface. On the left is a navigation menu with options like 'Coordinator Request', 'Students', 'Courses', etc. The main area is titled 'Select Course' and shows a table of courses. Below it is a 'StudentList' table with columns for S.No., Student Registration, Sex, Education, First Name, Middle Name, Last Name, and Exam Marks. To the right is a sample digital certificate for Mr. Vivek Ajaykumar Jaiswar, titled 'CERTIFICATE OF PARTICIPATION IN ONLINE COURSE'. The certificate includes the IIRS logo, the Government of India emblem, and details of the course: 'Basics of Geocomputation and Geosw Services' conducted by Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun during 19-10-2020 to 29-10-2020. The total course duration is 13 hours and 30 minutes.

Figure 24- Digital Certificate generation module in E-CLASS

## 5.6 Course Management and Administration System

Dedicated module is developed for the management of the course, students etc. This component have many sub modules like report generation, feedback analysis, attendance monitoring, coordinators awards, certificate verification and certificate issue. A detailed summary of all the courses is also available in the dashboard (Figure 25.)

The screenshot shows the 'Content Management dashboard for IIRS program coordinator'. It features four summary cards: '269319 Calendar Year wise distributions of the participants', '269319 Financial Year wise distributions of the participants', '2661 Distribution of Network Institutions', and '9,823 Details of e-learning Participants'. Below these is a red banner stating 'Total Participants Benefitted under live and interactive Programme(EDUSAT): 269319' and 'Total Network Institutes benefitted so far: 2661'. The main section is a 'Summary Report of IIRS Outreach Programme' table with columns for Course ID, Course Name, Coordinator, Start Date, End Date, Total Institutes, Total Registration, Total Approved, Total Exam Pass, Total Issue Certificate, and Status.

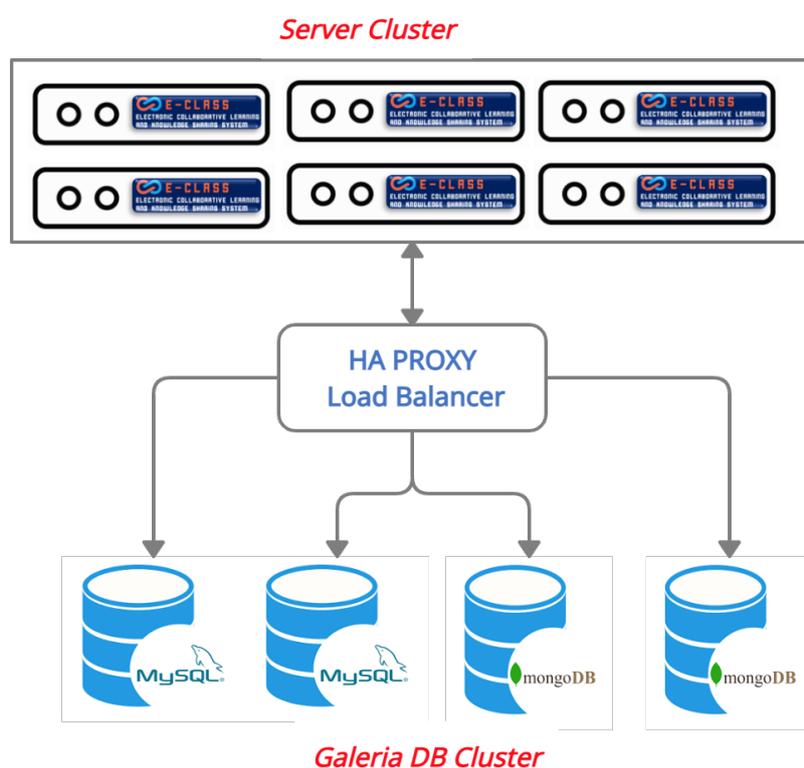
Course ID	Course Name	Coordinator	Start Date	End Date	Total Institutes	Total Registration	Total Approved	Total Exam Pass	Total Issue Certificate	Status
9013	Health GIS - Geoinformatics for COVID19	Dr. Sameer Saran	2020-06-15	2020-06-19	494	3601	2963	1352	1352	Completed
9012	Basics of SAR Remote Sensing	Dr. Shashi Kumar	2020-05-26	2020-05-30	342	2679	2179	681	681	Completed
9011	Basic Principles of Remote Sensing Technology	Dr. Harish Kamatak	2020-04-13	2020-04-25	437	7568	6273	2700	2700	Completed
7008	RS, GS and GNSS Applications for Disaster Management	Dr. Arjit Roy	2020-11-23	2020-11-27	1	104	97	0	97	Completed
7007	Special Course on RS, GS and GNSS Application for Disaster Management and DRR for Working Level Professionals	Dr. Arjit Roy	2020-10-26	2020-10-31	2	36	30	0	30	Completed
7006	Relay-based SAR Remote Sensing for Characterization of Manmade and Natural Features	Dr. Shashi Kumar	2020-10-26	2020-11-06	4	35	32	0	0	Completed

Figure 25- Content Management dashboard for IIRS program coordinator

## 5.7 Performance Enhancement

E-CALSS portal is a critical infrastructure for conduction of live and interactive programme. The number of concurrent users during the live session are very large i.e. about 10,000 to 15, 0000 depending upon course popularity and number of registrations. To get best performance of the system, the software architecture is re-designed and further upgraded in year 2021. The python based Django framework is used for development of user login and attendance APIs using JSON Web Token (JWT). The Gunicorn web server gateway is implemented to manage the large number connections during live session. The Gunicorn "Green Unicorn" is a Python Web Server Gateway Interface HTTP server. It is a pre-fork worker model, ported from Ruby's Unicorn project.

The hardware configuration is further scaled-up with addition computer nodes in HAProxy cluster. The cluster based architecture is very effective to improve the performance of the software application. The Galera setup is deployed for database cluster management within the HAProxy setup with four servers in place.



*Figure 26- Cluster setup to enhance the performance of E-CLASS platform*

## 5.8 Space education in Hindi language

(<https://antrikshgyan.iirs.gov.in>)

This website is designed and developed to disseminate space education in Hindi language. It is designed per GOI guidelines. The portal consists of video lectures in Hindi language on various aspect of space technology along with various scientific documents published in Hindi language. The portal also contain informational flyers on space technology. Figure 15 shows the main page of the portal.

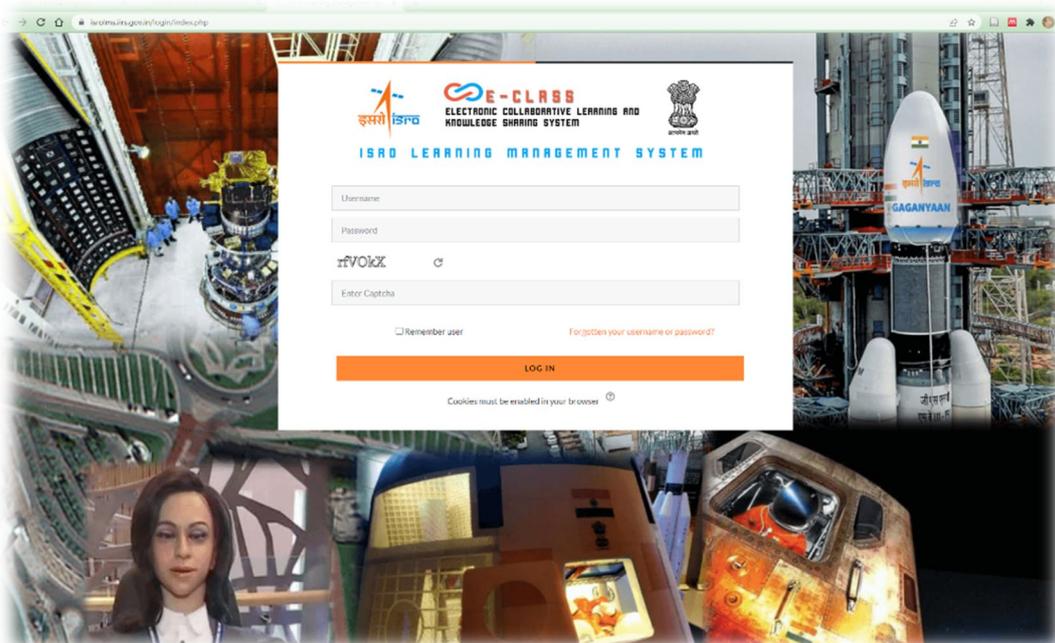


Figure 27- Antriksh Gyan Web Portal

## 5.9 Learning Management System for ISRO Centers

(<https://isrolms.iirs.gov.in>):

Based upon the request from ISRO HQ, the learning management system is designed and developed to meet the requirement of capacity building of other ISRO centers. The portal is being used by the Human Space Flight Center (HSFC) for their capacity building program. Figure 16 shows the LMS for ISRO centers.



*Figure 28- ISRO Learning Management System*

## 6. Feedback Report of the online courses

At the end of each course, the participants provides their feedback regarding the course. IIRS E-CLASS platform is having a tool to take feedback of the participant at end of each course. The feedback and stored in the database and a report is generated for further analysis. The feedback summary of all the courses conducted in year 2021 is presented below. Overall feedback of all the online courses conducted in 2021 is promising and encouraging. The participants found the sessions interesting and indicated that most of their doubts were answered by the faculty during interactive sessions and panel discussions. The course content was appreciated by the participants for its depth and range. The session delivery by the experts which included theoretical concepts coupled with practical applications of the technology was highly appreciated. The participants have expressed their interest to participate in similar programmes for RS&GIS technology and thematic applications. IIRS initiatives of making learning available in the safety and comfort of their homes during covid-19 lockdown period was well appreciated. Due to large number of participation, during the interactive session, the questions were moderated by subject expert. Some of the major difficulties raised by the participants are limited practical demonstrations and Internet connectivity issues at their end. The feedback report presented **below consists of responses from 20,000+ participants** in all the courses conducted in 2021. Figure 29 and 30 shows the feedback analysis for DLP courses.

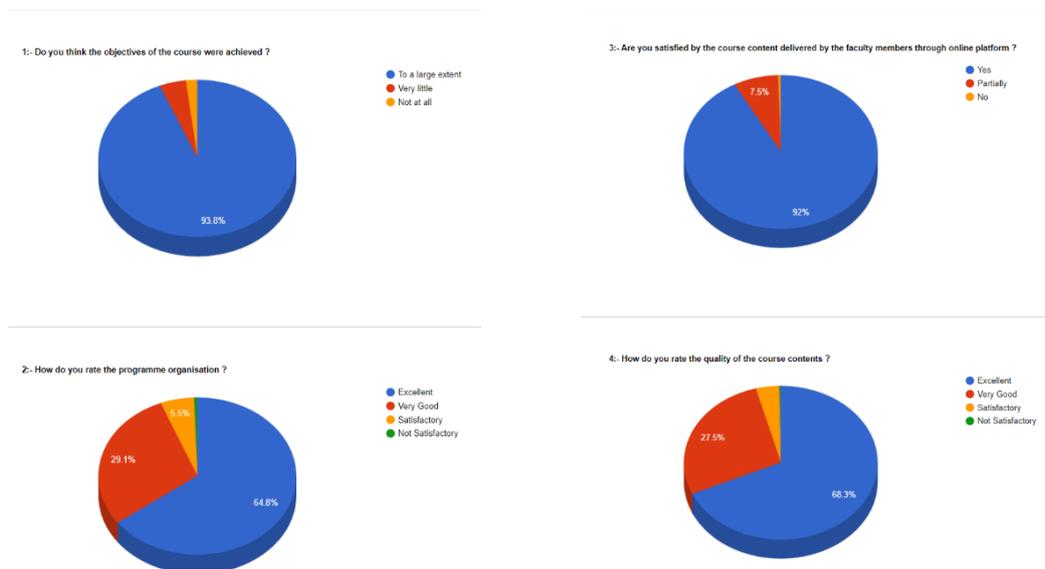


Figure 29- Feedback summary report- Part 1

First feedback question was “Do you think objective of the course were achieved?” The 93.8% participants has responded as “To large extend” and 4% says “Very little”. It is very encouraging to note that about 98% participants are satisfied with course contents delivered during live sessions. About 93% participants are rating programme organization as Excellent to very good. Around 92% participants are satisfied by the content delivery and 95% have rated the content quality as Excellent. About 86% participants are satisfied with time assigned for each topic. The next part of the feedback survey is shown in figure 33.

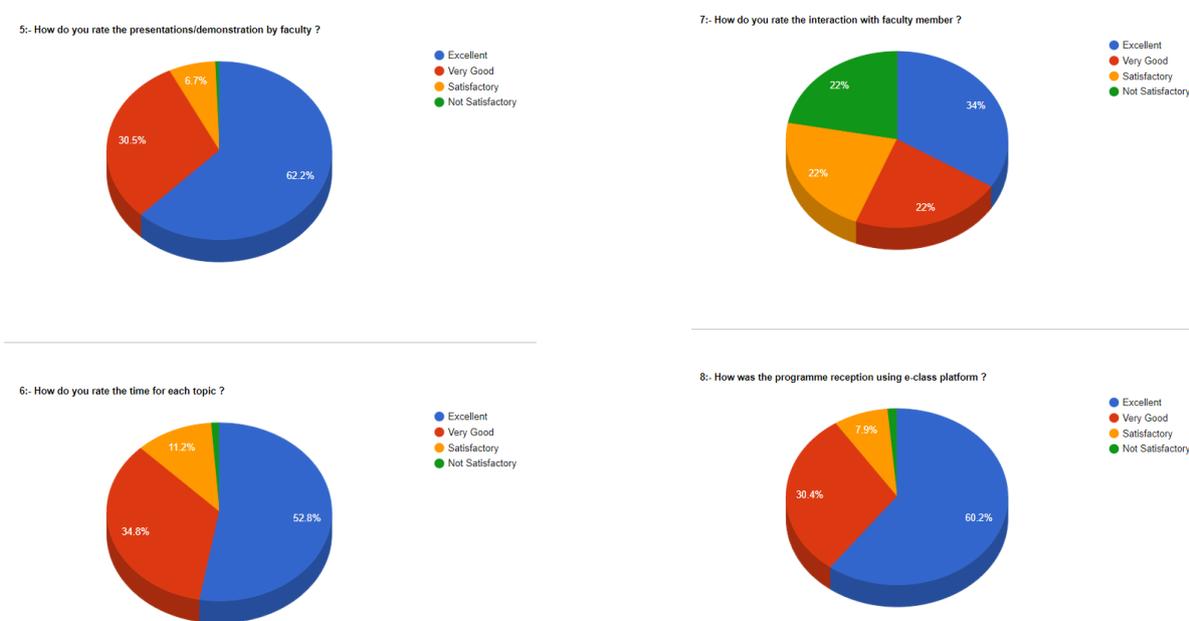


Figure 30- Feedback summary report- Part 2

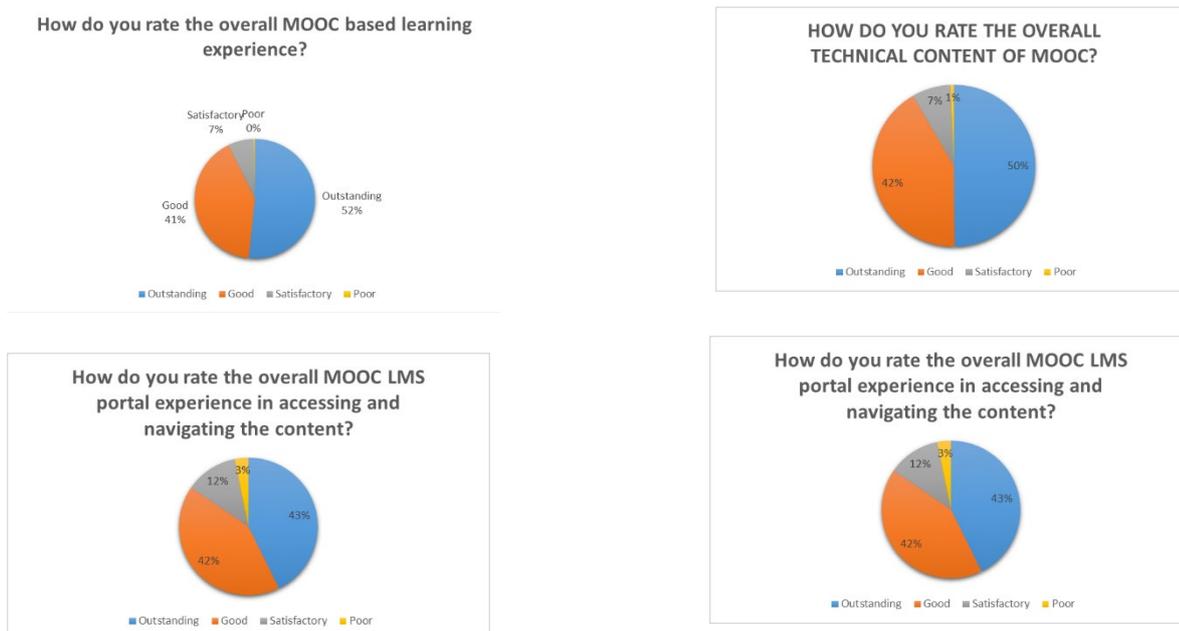
About 56% participants rate the interaction with faculty as excellent to very good. However, in this area there is good scope of improvement. Due to large number of participation, it is very difficult for a teacher to take all the questions of the participants during interactive session. However, IIRS team is working on developing new methods of interactions in E-CLASS platform. The programme reception through E-CALSS was rated from excellent to very good by 90% participants. The overall rating to the online course was very encouraging where 93% participants have rated it from excellent to very good.

Along with course related feedback, the participants were also asked to provide feedback on the utility of IIRS online course in their professional and academic careers. About 55% participants felt that the online will definitely help them progress in their career. However 40% participants said that it will help them in a limited manner.

The participants also provided suggestions for improvement of future online course. Some of them are listed below:

- There should be more practical based sessions focusing on local issues.
- Multilingual classes/ materials may be provided wherever possible.
- Provision of helpdesk with support for learners who find technical difficulties.
- Internship opportunities/project opportunities for students.
- Summarizing the topic and suggest reading material at the end of the lecture/discussion.
- There should be more demand-based classes for students from disciplines such as health, Humanities & Social sciences.
- Management and execution team of IIRS DLP courses should visit the networked Institutions for further guidance and monitoring.
- Apart from regular course modules, special personalized courses can be undertaken for specific subjects and participants such as civil servants.

The feedback report of MOOC under ISAT programme is presented below in Figure 19:



*Figure 31- Feedback summary report MOOC under ISAT*

The feedback on MOOC was taken on four basic question. It is very motivating to note that the 93% participants were able to enhance their skills through the MOOC. There is a scope to further improve the course contents and delivery mechanism for better user experience.

## 7. Conclusion & Future Directions

Due to prevailing restrictions in the country, online learning methods for teachers and students have emerged as innovative and alternative approach in training education. IIRS has conducted different online courses in year 2021 on basics and advanced concepts of Remote & GIS technology and its applications. These online courses became very popular among the learners where large number of participants have participated in these courses. The online course of IIRS has attracted the all the sections of the society and beneficiaries of these course varies from school students to senior citizens of the society. This year large number of working professional have also joined the online course of IIRS to enhance their technical skills to improve their work efficiency and career growth. The different types of online courses/workshops/webinar series were conducted by IIRS by targeting different user groups in the society. The types and mode of online contents were continuously improved to maintain the interest of the learners. It was also observed that many participants are joining multiple courses offered by IIRS. The engagement of the learners in learning process was achieved by developing innovating learning tools in E-CLASS platform. The conduction of random class activities like quiz, monitoring of attendance and discussion forums are very effective to keep the learners active during the online courses.

The E-CLASS platform of IIRS has emerged as an effective tool for teachers and online learners. The live sessions for large number of participants were successfully conducted by using E-CLASS platform. IIRS has successfully scaled up the technology and IT infrastructure to meet the large user requirements. The cluster based system architecture proved to be one of the best solution for getting required performance of the system during live sessions. In live sessions, large number of users are accessing the web application at same time. Sometime, it was obvious to record overutilization of computation resources during live sessions. Another critical challenge was to take the questions from the large number participants during interactive session. This was achieved by introducing voting based system in Question tab. The good questions received maximum votes from the participants. The questions with maximum number of votes are presented to the teachers for discussion during interactive session.

One of the critical gap in conduction of online courses was limited practical experiments by the participants. Although sufficient number of demonstration were shown to participants during the courses, but still it was reported as one of the limiting factor in the online course. The availability of virtual lab for the students may fill this gap. IIRS is putting effort to setup a virtual lab for online courses. There is also a requirement to further scale up the IT infrastructure for E-CLASS platform to accommodate more number of online learners during the live sessions. There is also a need to develop mobile applications for IIRS E-CLASS platform with innovative tools to keep the learners active during the sessions. The conduction online examination is also a challenge during lockdown period as supervision of the examination by the coordinator is not possible. The new approaches for student's assessment needs to be developed in online learning platforms.

## Bibliography

- Alawamleh, M., 2020. COVID-19 and higher education economics. *Journal of Economics and Economic Education Research*, 21(2), pp.1-2.
- Bao, W., 2020. COVID-19 and online teaching in higher education: A case study of Peking University. *Human Behavior and Emerging Technologies*, 2(2), pp.113-115. doi: 10.1002/hbe2.191
- Basilaia, G. and Kvavadze, D., 2020. Transition to online education in schools during a SARS-CoV-2 coronavirus (COVID-19) pandemic in Georgia. *Pedagogical Research*, 5(4), pp.1-9. doi: 10.29333/pr/7937
- Chick, R.C., Clifton, G.T., Peace, K.M., et al., 2020. Using technology to maintain the education of residents during the COVID-19 pandemic. *Journal of Surgical Education*. doi: 10.1016/j.jsurg.2020.03.018

- Collins, A. and Halverson, R., 2018. Rethinking education in the age of technology: The digital revolution and schooling in America. Teachers College Press.
- Crawford, J., Butler-Henderson, K., Rudolph, J., 2020. COVID-19: 20 Countries' Higher Education Intra-Period Digital Pedagogy Responses. Journal of Applied Teaching and Learning (JALT), 3(1).
- Daniel, S.J., 2020. Education and the COVID-19 pandemic. Prospects, pp.1-6. doi: 10.1007/s11125-020-09464-3
- Karnatak, H.C., Srivastav, S.K., Tiwari, P.S., Kumar, A.S., Vishwakarma, J., Kavitha N, Ghildiyal, A., Pandey, K., - IIRS, ISRO. An innovative approach for mass level capacity building in Geospatial technology and its applications using online active learning platforms - ISPRS TC V/4 & V/6: Online Platforms for Education & Outreach , IIRS, ISRO , Special Session (SS-13: ISPRS TC V/4 & V/6), ACRS-2017
- Krishna Murthy, Y. V. N., Raju, P. L. N., Srivastav, S. K., Karnatak, H., Kumar Gupta, P., Mahadevaswamy, M., and Viswakarma, J. (2014), — Reach the Unreached -IIRS Outreach program for enhanced learning to all, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences., XL-8, 1243-1247, doi:10.5194/isprsarchives-XL-8-1243-2014, 2014.
- Murphy, M.P., 2020. COVID-19 and emergency eLearning: Consequences of the securitization of higher education for post-pandemic pedagogy. Contemporary Security Policy, pp.1-14. doi: 10.1080/13523260.2020.1761749

### Important Links

- Course delivery will be through IIRS-ISRO E-CLASS platform- <https://eclass.iirs.gov.in>
- IIRS E-learning port- <https://elearning.iirs.gov.in>
- Course updates, and other details will be available at- <https://www.iirs.gov.in/EDUSAT-News>
- Coordinator registration at- <https://elearning.iirs.gov.in/edusatregistration/coordinator>
- Registration of the participants- <https://elearning.iirs.gov.in/edusatregistration/student>
- Course guideline for the participants- [https://eclass.iirs.gov.in/assets/guidelines\\_for\\_participants.pdf](https://eclass.iirs.gov.in/assets/guidelines_for_participants.pdf)