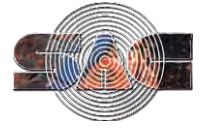




Centre for Space Science and Technology
Education in Asia and the Pacific



ANNOUNCES

THIRD POST GRADUATE COURSE ON GLOBAL NAVIGATION SATELLITE SYSTEMS

ACADEMIC YEAR 2019 - 2020



Centre for Space Science and Technology
Education in Asia and the Pacific
(Affiliated to the United Nations)
IIRS Campus, 4, Kalidas Road,
Dehradun 248 001 India
www.cssteap.org



Conducted at :

Space Applications Centre
Indian Space Research Organisation
Department of Space, Govt. of India
Ahmedabad-380015, India.
www.sac.gov.in





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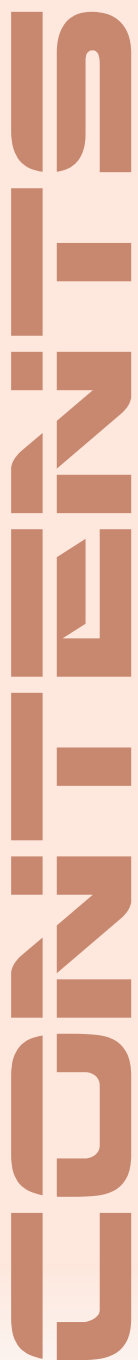
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For further details, please visit website (www.cssteap.org)





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INTRODUCTION

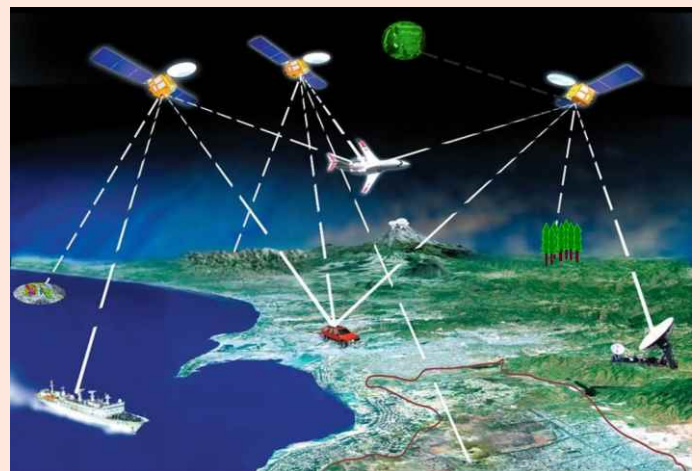
Since last many years, Satellite navigation has taken the world by storm and there is tremendous interest in navigation and navigation products. Major nations are making huge investments in establishing their own global or regional navigation systems for civilian and military applications. Apart from GPS (Global Positioning System) of the United States, Russian Federation has established GLONASS (GLObal NAVigation Satellite System), Europe is developing GALILEO and China is working on COMPASS/BeiDou navigation system. In addition to these global navigation systems, regional navigation systems have been conceived by India and Japan. Japan is developing its regional navigation system Quasi-Zenith Satellite System (QZSS). India has established its own regional navigation system, NavIC (Navigation with Indian Constellation) comprising 7 satellites.

Satellite navigation has also become an important and integral part of our daily lives. With almost every mobile phone having navigation application, we no longer depend on the human interaction to find our destination. Combined with the applications like Google and Bhuvan maps, finding a destination has become easy and hassle free. Navigation has become a necessary part of several commercial operations like online cab service, food delivery, e-commerce, cargo tracking, travel, agriculture etc. Hence, the knowledge of satellite navigation fundamentals, technologies and applications is surely very

useful for developing nations. Keeping this in view, the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) is offering a 9-month post-graduate course in Global Navigation Satellite Systems (GNSS) with integrated M.Tech. degree.

All countries should have access to space technology and must share the benefits. An essential prerequisite to partaking in these opportunities is the building of various indigenous capacities for the development and utilization of space science and technology. In recognition of such a prerequisite, a consensus has emerged within the international community that if effective assimilation and appropriate application of space technology are to succeed in the developing countries, devoted efforts must be made for capacity building at the local level, for the development of necessary high-level knowledge and expertise in space technology fields. Towards this end, the United Nations General Assembly had called for the establishment of Centres of Space Science and Technology Education at the regional level in the developing countries.

Under the auspices of the United Nations, through its Office for Outer Space Affairs (UNOOSA), six regional Centres are established on the basis of regions that correspond to the United Nations Economic Commissions: Asia and the Pacific (India, China), Latin America and the Caribbean (Brazil & Mexico), Africa (Morocco, Nigeria) and Western Asia (Jordan). All of these Six Centres are affiliated to the United Nations through UNOOSA. These Centres use





existing facilities and expertise already available in education and other research institutions in their respective regions.

ABOUT REGIONAL CENTRE FOR ASIA AND THE PACIFIC IN INDIA

The Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), affiliated to the United Nations was established in India in November, 1995. The Centre's headquarter is established in Dehradun, India around the infrastructure available at the Indian Institute of Remote Sensing (IIRS), Indian Space Research Organisation (ISRO), Government of India, Dehradun. For conducting its programs, CSSTEAP has arrangements with Department of Space (DoS) at its campuses at:

- Space Applications Centre at Ahmedabad, for programs related to Satellite Communications, Global Navigation Satellite System and Satellite Meteorology and Global Climate;
- Physical Research Laboratory, Ahmedabad, for program related to Space and Atmospheric Sciences; and
- IIRS, Dehradun, for program related to Remote Sensing and GIS.

GOALS OF CSSTEAP

CSSTEAP is an education and research institution, capable

of high attainments in the development and transmission of knowledge in the fields of space science and technology. The Centre offers best possible education, research and application experience to its participants in all its programs. The principal goal of the Centre is development of skills and knowledge of university educators and researchers, engineers, application scientists and government officials through rigorous theory, research, applications, field exercises and pilot-projects in those aspects of space science and technology that can enhance social and economic development in each country. The programs aim at development of indigenous capability of participating countries, in designing and implementing space-based research and applications programs. The Centre will also foster continuing education programs for its graduates and awareness programs for policy and decision-makers and the general public.

It should be emphasized that the overall mission of the Centre is to assist participating countries in developing and enhancing the knowledge and skills of their citizens in relevant aspects of space science and technology in order that such individuals can effectively contribute to national development programs.

AFFILIATION TO THE UNITED NATIONS

The Centre has entered into a cooperative agreement with the United Nations which states that the United Nations will cooperate with the Centre by providing expert advice,



educational curricula, technical support, necessary documentation and other appropriate support.

EDUCATIONAL PROGRAMS AND COURSES

The educational programs of the Centre are oriented towards the dissemination of knowledge in relevant aspects of space science and technology. The initial emphasis of the Centre is to concentrate on in-depth education, research & applications programmes, and linkages to the global programs/databases, execution of pilot projects, continuing education and awareness and appraisal programs. Scholars and professionals, who contribute to the educational programs are renowned experts in their respective fields from both within and outside the region.

The activities of the Centre are guided by an International Governing Board, International Academic Advisory Committee and Board of Studies. These curricula have been reviewed by an international Advisory Committee of CSSTEAP from time to time and ratified by the UN Office for Outer Space Affairs (UNOOSA).

ACADEMIC ACTIVITIES

The academic activity is divided into two phases. Phase-I is of 9 months' duration and executed at the Centre in India. After successful completion of the Phase-I, the participants are encouraged to take up Phase-II research project of one-year duration in their home country. Phase-II allows participants to take up research project relevant to their home country or organization and apply the technologies. Centre also offers fellowships to the meritorious

candidates to do research in Phase II in India.

The Centre offers Post Graduate level courses in the fields of:

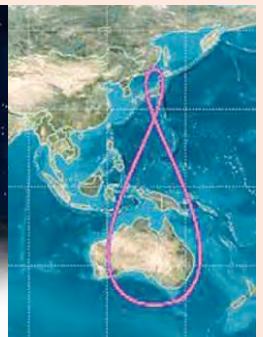
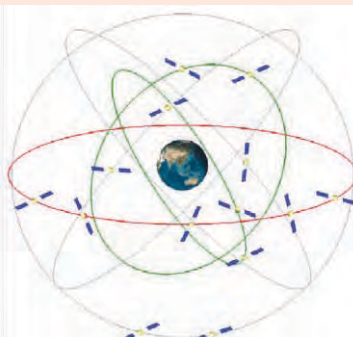
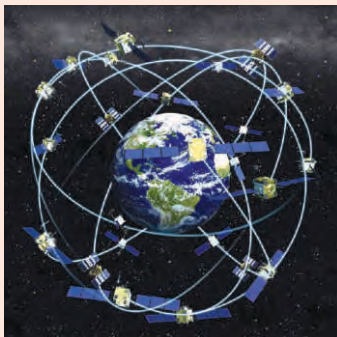
- Remote Sensing and Geographic Information System (RS and GIS), organized every year
- Satellite Communications (SATCOM), organized every odd year
- Global Navigation Satellite Systems (GNSS), organized every odd year
- Satellite Meteorology and Global Climate (SATMET), organized every even year
- Space and Atmospheric Sciences (SAS), organized every even year

Besides post graduate level courses, the Centre also conducts short courses/workshops on the above subjects on specific themes of space science and technology.

The Post Graduate courses are organised in two phases:

Phase-I (9 Months, in India)

- **Core Modules**, where the emphasis is on the development and enhancement of the knowledge and skills of university educators, researchers, engineers, application scientists and government officials.
- **Pilot-Project**, oriented towards planning and executing project which provides an opportunity to fine-tune the skills for executing theme-based study.



Phase-II (1 Year, in home country)

- **Research Project** for scholars to conduct and execute projects in their respective country with a view to transfer the technology in his/her organization. It will also be a test of the methodology and knowledge assimilated during Phase-I at the centre.
- A few meritorious students of PG course are also considered for award of additional fellowship of six months to one year to complete part of their research work at centre's host institutions in India which may lead to a M. Tech. degree conferred by Andhra University.

COURSE RECOGNITION BY ANDHRA UNIVERSITY

CSSTEAP has arrangement with Andhra University (Estd. 1926), Vishakhapatnam, India for awarding Master's (M.Tech.) degree subject to the eligibility criteria of the Andhra University. After successfully completing the 9-months P.G. Diploma course candidate should complete one-year project work successfully for award of Master of Technology (M.Tech.) degree. The terms and conditions of this arrangement are subject to review from time to time by the Andhra University.

PROGRAMMES ORGANISED

The Centre has so far conducted 22 Post Graduate Courses

in Remote Sensing and Geographic Information System. 11 Post Graduate courses in Satellite Communication, 10 Post Graduate courses in Satellite Meteorology and Global Climate, 10 Post Graduate courses in Space and Atmospheric Sciences and 2 Global Navigation Satellite Systems courses. The centre also has conducted various short Courses/Workshops from its inception. These educational programmes have benefited more than 2000 scholars from 36 countries in the region. 23rd RS & GIS PG course at IIRS Dehradun, 11th SATMET PG Course at SAC, Ahmedabad and 11th Space and Atmospheric Sciences (SAS) PG course at PRL, Ahmedabad are in progress.

ANNOUNCEMENT OF THIRD POST GRADUATE COURSE IN GLOBAL NAVIGATION SATELLITE SYSTEMS

Duration:	9 Months – from August 1, 2019 to April 30, 2020.
Venue:	Space Applications Centre Indian Space Research Organisation Department of Space, Govt. of India Ahmedabad-380 015, India.
No. of Participants:	15 (fifteen)



IMPORTANT DATES FOR GNSS-3 COURSE

Last date for Receipt of Applications	April 15, 2019
Information of Selection	May 15, 2019
Commencement of Course	August 1, 2019
Completion of Phase-I (in India)	April 30, 2020

INVITATION OF NOMINATION AND SPONSORSHIP

Nominations are invited from candidates in countries of Asia and the Pacific Region for the educational programme of the Centre. Nominations of candidates will have to be endorsed/sponsored by recognized institutions (e.g. ministries, universities, organisations etc.) in their respective countries. Endorsing/ sponsoring institutions should ensure that the returning scholar will contribute in development oriented activity in the area of newly acquired knowledge and skills. The execution of a one-year project work in their respective countries is the beginning of this process for which the nominating institution should ensure that essential facilities and support would be provided to the participant. During this

one-year period, the Centre will provide net based scientific guidance.

SUBMISSION OF APPLICATIONS

All the participants from member countries are required to forward their application through respective Governing Board (GB) members to the Indian Embassy/High Commission in respective country, who will then forward application to the course director. The participants from non-GB countries need to submit duly filled application to the centre through Indian Embassy/High Commission in their country.

Completed application forms should be sent through the Embassy/High Commission of the respective country to:

Course Director, GNSS-3
 CSSTEAP
 Room No:33, Building No:24A
 Space Applications Centre, ISRO
 Ambawadi Vistar P.O.,
 Ahmedabad - 380 015, INDIA
 Tel. No.: +91-79-2691 2433/2427
 Fax: +91-79-2691 5807
 Email: cssteapgnss@sac.isro.gov.in

The last date for receipt of completed applications is April 15, 2019. The application forms received from countries of Asia and the Pacific Region will be scrutinized by the Centre and the selected candidates will be informed by



May 15, 2019. Preference in selection is generally given to those candidates, whose expenses are borne by themselves / sponsoring agency.

IMPORTANT POINTS (Please read Carefully and note):

1. Interested candidates may detach/photocopy last four pages from this brochure and use it as Application Form.
2. It is essential that full passport details are provided in the Application Form. Application Forms without passport details may not be considered.
3. The language of the courses is English. Proficiency both in written and spoken English is **MUST**. **Candidates not proficient in English should not apply.**
4. Medical fitness for diseases like HIV, TB, Hepatitis B, Cancer, etc. or any communicable diseases requiring medical attention is must for all the candidates. If any information is hidden or found during the course, the Centre will be compelled to send the candidate back home at his own cost.
5. Applicant should attach copies of certificate of
 - a. Medical Fitness Certificate from an authorised government medical officer covering status of eye, chest (Tuberculosis), vaccinations, heart, lungs,

liver, spleen, hydrocele, skin & V.D., Hepatitis, HIV, Yellow fever and other contagious diseases.

- b. Highest degree obtained (Degree certificate and mark sheet/grade card).
 - c. Applicants, who have done their higher studies in a medium (language) other than English, are required to submit TOEFL score or a diploma/certificate of English language issued by an accredited language institution in the country or by the local UNDP.
 - d. All the degree certificates, if not in English may please be translated in English and attested by the Head of the organization or notary or transcript in English with seal.
6. Mail the completed application form through Indian Embassy/High Commission in your country.
 7. Please also directly email a scan-copy of the application form, duly signed by the nominating or sponsoring agency, to cssteapgnss@sac.isro.gov.in for advance processing.
 8. The candidate will be required to sign an undertaking at the time of registration that you will abide by the conduct rules and regulations of the institute. In case of the violations of the rules appropriate disciplinary action may be taken by the authorities as deemed appropriately, if needed it will be conveyed to your sponsoring organization and your Embassy in India.



ELIGIBILITY

Bachelor's Degree in Electronics/Telecommunications/ Electrical/Computer/IT Engineering or Master's degree in Science (Physics, Electronics, Geomatics) or equivalent with at least 5 years of experience in teaching/research or professional experience in the field of satellite navigation, geomatics, communication engineering and/or related field. The candidates should be nominated and/or sponsored by the organization for the disciplines they are working in. For the candidates with higher qualifications, the criteria of minimum experience may be relaxed.

TARGET PARTICIPANTS

The course is directed towards the following categories of professionals.

- University educators and researchers
- Professionals and specialists
- Navigation system managers, engineers and planners.

It is expected that at the end of the program, participating scholars will be able to

- Serve as catalysts for furthering the skills and knowledge of other professionals in their countries.

- They will contribute to policy making, planning, development and management of satellite positioning and navigation and its applications in their countries.
- Enhance the self-reliance of their countries so as to lessen dependence on external experts.

SELECTION OF CANDIDATES

Based on the completed application forms received, the Centre will select the candidates as per selection criteria set by a Selection Committee. Selection criteria include satisfying eligibility requirement, country representation, proficiency in English language, sponsorship etc. The result of selection will be intimated by May 15, 2019 and list of the selected candidates will also be put at CSSTEAP website (www.cssteap.org). Preference will be given to the sponsored candidates, whose nominating organization provides fully or partly international air travel (both ways) and/or fellowship.

ABOUT SPACE APPLICATIONS CENTRE (Host Institute)

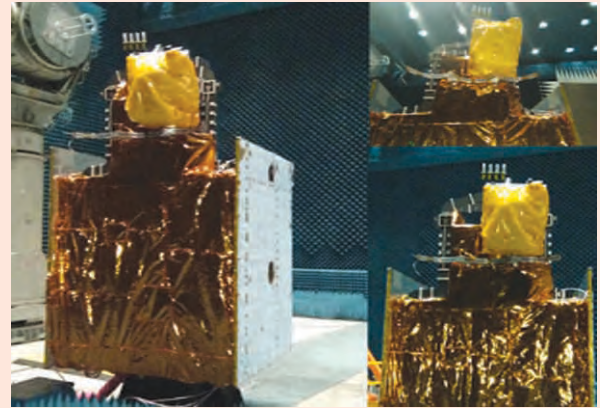
Established in 1972, Space Applications Centre (SAC), one of the lead Centres of the Indian Space Research Organisation (ISRO), is carrying out a wide range of scientific and technical activities, with emphasis on utility of space technology for societal applications.



SAC main campus is situated in the western outskirts of the city of Ahmedabad in Gujarat State, Western India. Two new SAC campus have been established ~8 km away from the main campus, which also houses training facilities and housing complex for CSSTEAP participants.

With a strong foundation of research & development, SAC develops advanced space borne payloads for Spacecraft along with a range of applications for the benefit of society. The applications primarily address communication, navigation and remote sensing needs of the country. SAC has also been instrumental in realizing scientific and planetary missions of ISRO including Mars and Moon missions.

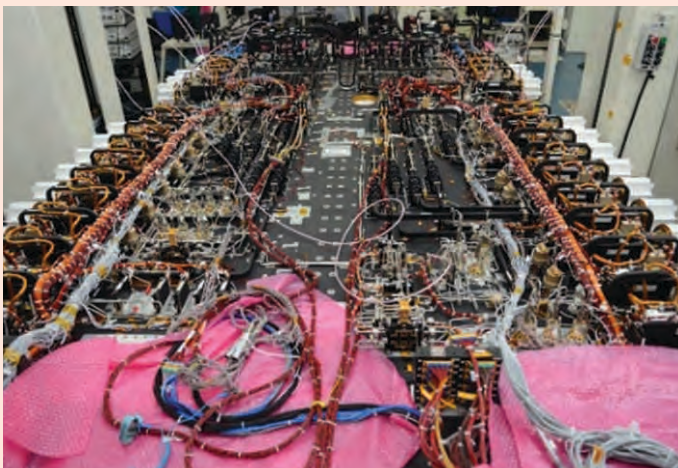
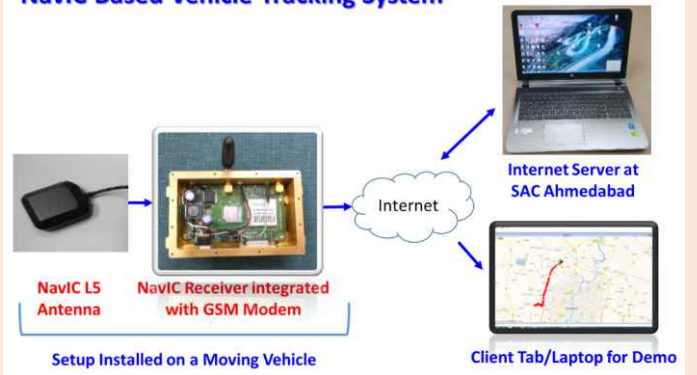
Communication: The communication transponders developed at SAC for INSAT and GSAT series of satellites are used by government and private sector for VSAT, TV broadcasting, DTH, DSNG, internet, telephony, mobile satellite services, search and rescue, data relay services, radio networking, tele-medicine, tele-education etc. The recent high throughput satellites in Ka/Ku band launched by ISRO will bring high-speed internet and FSS services at the doorsteps of people, government and industry. The development of Q/V band payloads and optical communication link between space and ground station are some of the new initiatives for future Satcom activities.



MSS payload checkout at CATF

Navigation: SAC has developed the payloads for the IRNSS/NavIC (Navigation with Indian Constellation) satellites and GPS Aided Geo Augmented Navigation (GAGAN). The NavIC and GAGAN services are regional services & cater to the Indian sub-continent for navigation applications.

NavIC Based Vehicle Tracking System



GSAT-11 Panel



GSAT-11 in clean room

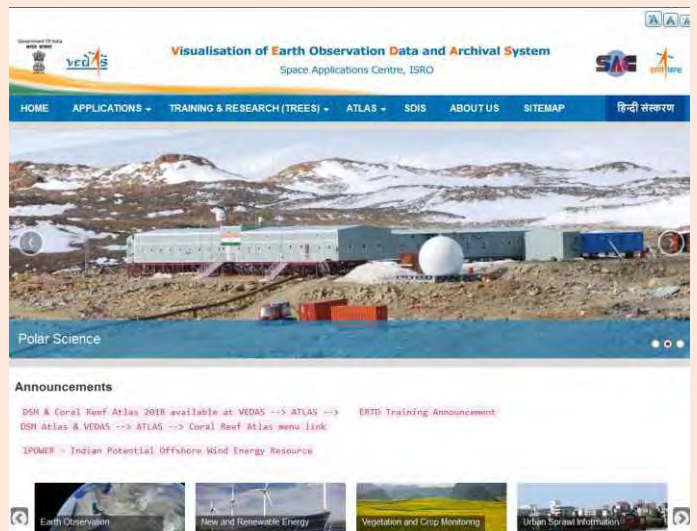
Remote Sensing: SAC is involved in design and development of airborne and space-borne multi-spectral & infrared optical and microwave sensors. SAC also develops signal and image processing software, GIS software and many applications for Earth Observation program in diverse areas of agriculture, forestry, coastal zone management, fisheries, urban planning, watershed development, ground water prospecting, snow & glacier studies, oceanography and atmospheric studies, early warning and disaster management support etc. SAC has developed web based real time data archival portals including Visualisation of Earth Observation Data and Archival System (VEDAS) as well as Meteorological and Oceanographic Data Archival Centre (MOSDAC).



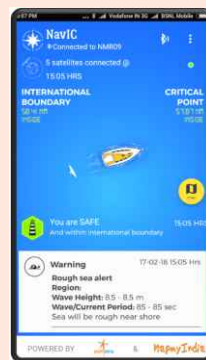
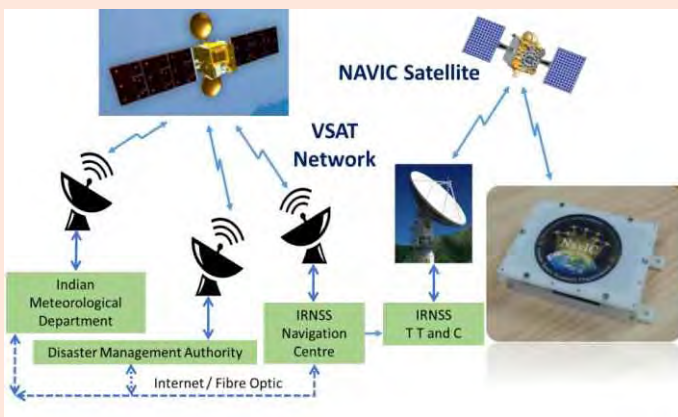
MOSDAC : LIVE



CARTOSAT-2S Image of an Airport



VEDAS



Space Exploration: ISRO has embarked on the space exploration with moon mission (Chandrayaan-1) and Mars Orbiter Mission (MOM). A second moon mission with orbiter, lander and rover (Chandrayaan-2) is slated in the first quarter of 2019. SAC has significantly contributed in realizing of payloads for these missions and analyzing data.

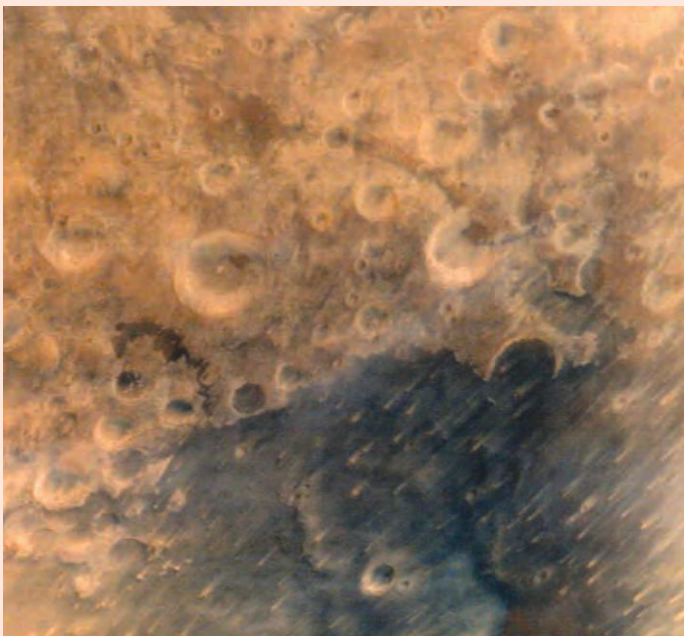
Infrastructure: SAC has a strong in-house infrastructure to support design, fabrication and testing of payload electronics and mechanical hardware while ensuring quality and reliability of the operation over mission life. Some of the major facilities are: Microelectronic Fabrication Facilities for Microwave Integrated Circuits (MIC), Monolithic MIC (MMIC), Surface Acoustic Wave (SAW) devices & Low-Temperature Co-fired Ceramic (LTCC) packaging, Payload Fabrication facility, Environmental Test Facility, Thermovac chambers, vibration and shock test facility, Precision mechanical fabrication facility with computer controlled CNC and EDM machines, components screening facility and Bonded store. Computer Aided Design (CAD) facility established in the centre facilitates mechanical and electronic design and drawing generation. SAC has a state-of-the-art, Planetary Simulation and Immersive Visualisation (PLASIV) lab for display of digital elevation models of satellite data.



New TVAC facility at Bopal, Ahmedabad



PLASIV Laboratory



Quality Assurance: SAC has a dedicated group responsible for the formulation and implementation of quality practices, to ensure that all projects undertaken, meet the high degree of quality and consistency. This is implemented through a comprehensive and all-encompassing quality program, covering all aspects of product development that includes multi-tiered design review; careful selection of components and materials; thorough qualification of fabrication processes; stringent quality control during fabrication; and comprehensive characterisation of the developed product through a rigorous test and evaluation. Each of these activities are regularly monitored through Audits. The quality program and practices are implemented not only within the centre, but at sub-contractor's facilities as well.

SAC has active collaborations with industry, academia, national and international institutes for research and development.

SAC has also established state-of-the-art in-house and mobile exhibitions to propagate Space applications & associated technologies amongst students and public at large.

SAC has a well-stocked library to support various R&D activities. The library is affiliated with many international repositories and national repositories like IEEE, SPIE etc. and users may use Wi-Fi to download e-papers and online journals.

The administrative divisions of SAC deal with personnel & general administration, purchase & stores, accounts & finance, etc.

SAC has a dedicated fraternity of 2000+ personnel, comprising of 1700+ scientific & technical personnel and 300+ administrative personnel.

ABOUT COURSE

MEDIUM OF INSTRUCTIONS

The language of the courses is English. **Proficiency both in written and spoken English is MUST. Candidates not proficient in English should not apply.** Applicants, who have done their higher studies in a medium (language) other than English, are required to submit TOEFL score or a diploma/certificate of English language issued by an accredited language institution in the country or by the local UNDP. The head of the nominating/sponsoring organization need to affirm the applicant's competence in spoken and written English language. Preference will be given to those who have secured high score in TOEFL examination. Supporting document regarding the accreditation of the institute should be enclosed along with the application.

FACULTY

The faculty for the course consists of scientists and engineers in different fields, drawn from Space Applications



Centre, other Centres of Indian Space Research Organisation (ISRO) and various other agencies/universities from India and other countries, mainly from Asia and the Pacific region. These experts have long and varied experience in the field of satellite navigation and positioning and their applications. The core faculty has a strong scientific background with a number of publications, experience of participating in international scientific programs and organizing a number of courses to their credit.

TECHNICAL FACILITIES

Space Applications Centre (SAC), Ahmedabad has state of the art GNSS receivers, simulators, signal monitoring facilities and various well equipped laboratories where research & development on GNSS and related topics are carried out. SAC has entire infrastructure to design, develop and fabricate satellite navigation payloads, GNSS receivers and Satellite Based Augmentation Systems (SBAS). SAC provides consultancy services to various agencies for installation and commissioning of GNSS applications.

COURSE METHODS AND TEACHING AIDS

ISRO has developed expertise in satellite navigation and its applications over last decade and launched a constellation of navigation satellites. Modern methods of teaching and instruction will be used for imparting training during the

course. Printed course material of the lectures will be supplied. The course methods include classroom lectures, video lectures, computer-based training packages, laboratory experiments, group discussions, demonstrations, seminar presentation and field work/case studies (as applicable). Computer-based interactive packages will also be used for self-learning.

TECHNICAL TOURS

As part of the course, the participants will have the opportunity to visit different centres of ISRO/Department of Space, Government of India and other prestigious organisations concerned with satellite navigation and positioning.

EVALUATION PROCEDURE

The performance of the participants will be assessed through both external and internal theory tests, practicals and computer-assisted interactive tests at periodic intervals during each semester of the course. Participants who are not able to qualify in the prescribed examinations for the 9-months course may be considered for award of only a "Certificate of Attendance" by the Centre.

AWARD OF DIPLOMA/DEGREE

On successful completion of the Phase-I of the 9-months course, the Centre will award Post Graduate Diploma Certificate. If an eligible participant completes Phase-II



Project work i.e. research project in home country satisfactorily within four years of joining of PG Course, the candidate may submit the work to Andhra University (India). The Andhra University will consider award of M.Tech. degree, provided that the participant satisfies their eligibility criteria.

COURSE EXPENSES AND FINANCIAL ASSISTANCE TO PARTICIPANTS

The overall expenses for the Course for each participant include Course Fee of Approx. US \$ 6000 besides cost for the international travel (to/from Ahmedabad), Local tours and Living expenses.

For this Course, Government of India (GOI) has offered to waive off the course fee of US \$ 6000 per participant of the Asia-Pacific region selected by the Centre. Thus, no course fee is payable by the selected participants from the Asia Pacific region. However, the participants, who find suitable sponsorship or funding for meeting these expenses, will be given preference.

Government of India has also offered to the participants from the Asia Pacific region the Fellowships consisting of the following:

- Living expenses in India - INR 16,000 per month for duration of 9 months
- Book allowance - INR 2,000 (one time)

- Project allowance – INR 1,500 (one time)
- Technical tour expenses.

The Centre is also trying to obtain financial assistance for international travel of the participants of the Asia-Pacific region through agencies like UN Office for Outer Space Affairs (UN-OOSA), UN Economic & Social Commission for Asia and the Pacific (UN-ESCAP).

Candidates proposing to avail the GOI Fellowship and the international travel assistance have to specifically request for the same in Application Form.

Preference will be given to the sponsored candidates, whose nominating organization provides fully or partly international air travel (both ways) and/or fellowship.

HEALTH AND LIFE INSURANCE

Medical, life and disability insurance should be undertaken before reaching India, by the participants themselves or on their behalf by their nominating / sponsoring institute/organisation for covering entire health and disability risks. No medical expenses will be borne by the Centre. However, participants who receive the fellowship of the GOI will be paid medical expenses for minor ailments on actual basis (as out patients only) as and when such expenses are incurred. The centre will have only limited liabilities as far as medical expenses are concerned in such cases. **Candidates must clearly specify**



if they are suffering from any health disorders which may affect their study programmes. Candidate in sound physical and mental health only need to apply. Participant, who is not covered by appropriate medical insurance while in India, would be required to take a medical insurance policy in India by themselves.

Medical fitness certificate from Authorised government medical officer covering status of eye, chest (Tuberculosis), vaccinations, heart, lungs, liver, spleen, hydrocele, skin & V.D., Hepatitis, HIV, Yellow fever and other contagious diseases be enclosed with the application form.

In case if any medical information requiring attention is hidden and if found during the course, the centre will be compelled to send the candidate back home and all expenses towards the same will be borne by the candidate/sponsoring organization.

ACCOMMODATION

Accommodation for the participants will be arranged in Hostel only. Kitchenette facility will be available to the participants. A sum of INR 1500/- per month is to be paid by each participant towards accommodation charges. Boarding and other expenses such as cooking gas are to be borne by the participants. Spouse or no other person will be allowed to stay along with the candidate in the hostel during the entire tenure of the course. Staying in hostel is compulsory for all the participants and staying outside is not allowed.

COURSE AT A GLANCE

PHASE - I: COURSE CONTENTS

Phase-1 of the course consists two semesters including the Pilot Project in the second semester. Each semester covers specific areas of global and regional satellite navigation systems. Laboratory experiments and practical demonstration using GNSS simulators and receivers will be conducted in all the subjects, wherever applicable. Broad topics covered in each semester are given below.



SEMESTER I (Duration: 3 months)

Foundation of Course: Welcome Introduction, Introduction to satellite communication and satellite navigation systems, Engineering Mathematics.

Fundamental of NAVCOM

-Introduction to SATCOM: Fundamentals of Satellite Orbits, EM Waves, Antenna, Modulation Techniques, Multiple access techniques, Channel coding and Digital Signal Processing.

-Introduction to SATNAV: GNSS Terminologies, Conventional Navigation Systems, Evolutions of GNSS, Ranging codes, Channel characteristics in Satellite Navigation Systems, Reference Co-ordinate Systems and its transformations

GNSS Signals and Systems:

-GNSS System Architecture & Signals: Concepts of frequency and time, Basic Attributes of GNSS Signals, Link Budget Analysis, GNSS interoperability, Error Correcting Codes, GNSS Navigation Message Structures, GNSS Signal case studies.

-Space Segment Elements: Satellite Navigation Constellation, Spacecraft Systems, Features of a navigation satellite, Navigation Payloads, Atomic Clocks, Active and passive Microwave subsystems, Satellite Navigation Antennas, Electrostatic hazards, Orbital perturbations

-Control Segment Elements: Basic elements of control systems, GNSS Reference Stations, GNSS System/Network Time, Two-way ranging, Time transfer and synchronization, Satellite Orbit Determination, Satellite clock Corrections, Operational Concepts.

-Advance Topics: LEO navigation constellation, Autonomous Navigation Concept, Future trends related to the overall system architectures.

Navigation Receivers: Generalized GNSS Receiver Architecture, Characteristics of GNSS Antenna, RF front end, Different Acquisition techniques, GNSS Signal Tracking, Coherent and non-coherent delay lock tracking, Navigation Data Demodulation, Decoding and Processing, Measurement of pseudo range, Receiver Testing, Multipath, Interference, Software Defined Radio, Kalman Filtering.

Position Determination Techniques: Principle of GNSS Operation, Trilateration Concept, Determination of satellite position and velocity, Code and carrier phase measurement, Position, Velocity and Time determination, Errors in GNSS measurements, Receiver Position Computation with Single Constellation and with Multi Constellation.

Seminar



SEMESTER II (Duration: 3 months)

Advanced receivers and Augmented Systems: Basics of Encryption and use in GNSS, Jamming and Spoofing, Differential GNSS, Real Time Kinematics, Advanced Receivers, Satellite and Ground Based Augmentation Systems, Pseudolite System, GNSS Networks.

GNSS, INS and Integrated Navigation: Inertial Navigation Systems, Inertial Sensors, functional aspects, GNSS-INS Integration, indoor navigation and Applications of integrated navigation.

GNSS Applications: Overview and designing of applications, Detailed study on Societal, Scientific and strategic Applications and Revenue model for applications.

Space Weather and GNSS:

-Ionosphere: Definition, structure and dynamics, Estimation and corrections – Dual frequency measurements, Monitoring of Ionosphere by ground and space based measurements, Ionospheric scintillation Ionospheric corrections and threat models.

-Space Weather - Overview and elements of space weather (e.g., Sun, Solar activities), Magnetosphere, Thermosphere, Interaction of Solar wind with earth's magnetosphere and its effects, Geomagnetic storms and sub-storm, Particle trapping and Van Allen Belt.

-Impact of space weather events on GNSS

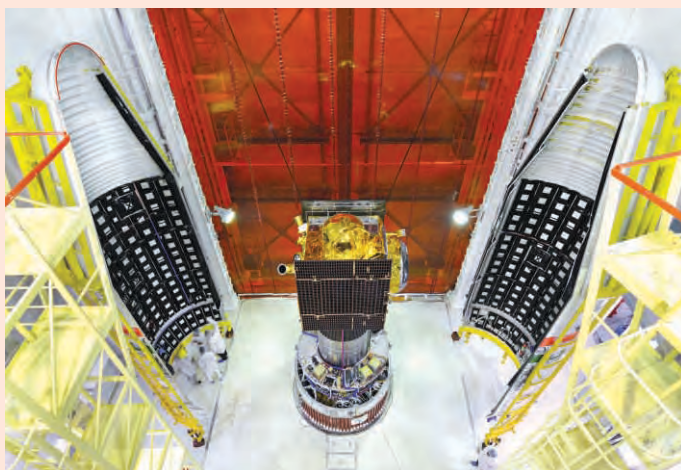
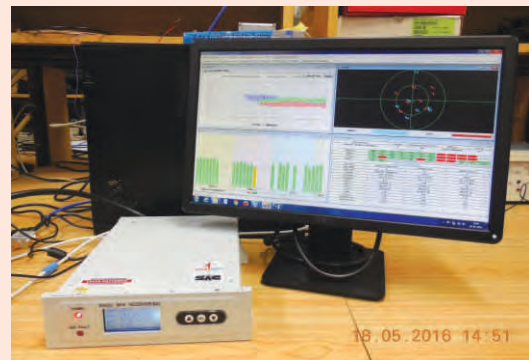
Satellites: Energetic particles bombardment and

interference with solar radio emission.

Signals and Receivers: ionospheric plasma enhancement, plasmaspheric variation, plasma instabilities and irregularity formation and effects on Radio wave propagation like scintillation

PILOT PROJECT

Project definition, considering needs of the participant's country, topic of interest of the participant and Work leading towards the one-year project.



CREDIT SYSTEM

Credits will be awarded to the participants based on evaluation through internal and external tests and practicals. Topic-wise credit system, followed for the Course, is given below.

Post Graduate Diploma Course in Global Navigation Satellite System Credit System

PAPER	SUBJECTS	SUBJECT CREDITS
SEMESTER-I		
MGNSS.I.1A	Foundation course	3
MGNSS.I.1B	Foundation course Lab	1
MGNSS.I.2A	Fundamentals of NAVCOM	2
MGNSS.I.2B	Fundamentals of NAVCOM Lab	2
MGNSS.I.3A	GNSS Signals and Systems	5
MGNSS.I.3B	GNSS Signals and Systems Lab	3
MGNSS.I.4A	Navigation Receivers	4
MGNSS.I.4B	Navigation Receivers Lab	2
MGNSS.I.5A	Position Determination Techniques	4
MGNSS.I.5B	Position Determination Techniques lab	2
MGNSS.I.6	Seminar	2
Semester-I Total Credits		30
SEMESTER-II		
MGNSS.II.1A	Technologies for Advanced receivers and Augmented Systems	4
MGNSS.II.1B	Technologies for Advanced receivers and Augmented Systems Lab	2
MGNSS.II.2A	GNSS/INS Integrated Navigation	3
MGNSS.II.2B	GNSS/INS Integrated Navigation Lab	1
MGNSS.II.3A	GNSS Applications	4
MGNSS.II.3B	GNSS Applications Lab	2
MGNSS.II.4A	Space Weather and GNSS	2
MGNSS.II.4B	Space Weather and GNSS Lab	2
MGNSS.II.5	Pilot Project	10
Semester-II Total Credits		30
TOTAL		60

PHASE – II: ONE YEAR PROJECT

Each eligible scholar, after completing Phase-I of the course, will have to carry out an approved project in his/her home country for a period of one year. This is to be formulated jointly by the scholar and his/her advisor at the Centre during Phase-I in an area relevant to the development of the nominating institution/country. The nominating institution/country is obliged to guarantee that the scholar, on the return, will be provided all facilities to carry out the research work.

In order to make the best use of the knowledge and skill acquired by the participant, the nominating agency is also expected to ensure that the returning scholar would remain in a suitable position with commensurate and progressive remuneration and other entitlements for a minimum period of 3 years and will be provided all facilities to carry out the work. However, few meritorious students will be awarded six months to one-year fellowship as per the requirement to complete their one-year project work at CSSTEAP, India. The awardee will be provided support for international travel, travel in India and fellowship.

This course program will be considered complete on acceptance/approval of the submitted project report by Andhra University (India).

ABOUT ANDHRA UNIVERSITY

Andhra University was established in 1926. It is a premier institute of higher learning and a trend-setter in higher education and university administration. It is accredited with 'A' Grade by National Assessment and Accreditation Council of India and is the first composite university in India to get ISO 9001–2008 certificate. Andhra University is a multi-disciplinary university. The University has strong faculty and was headed by the greatest personalities like Dr. C.R. Reddy, Dr. S. Radhakrishna and others as Vice-Chancellors. Andhra University is one of the premiere Universities in India in terms of Research by the Department of Science and Technology, Govt. of India. Andhra University has one of the biggest Engineering Colleges consisting of large number of Engineering Departments offering UG and PG programs. It has chemical, Electronics and Communication, Computer Science and Systems, Civil, Mechanical, Remote Sensing, Marine, Naval Architecture, Architecture and Planning, Metallurgical, Instrument Technology, Environmental, Electrical and Electronics Engineering Departments. It also offers PG programs in 42 specializations in the above Departments including Nanotechnology, Bio-informatics, Bio-medical, Geo-informatics etc. All the courses are accredited by NBA for 5 years indicating 'A' Grade.



ABOUT AHMEDABAD CITY

Ahmedabad is an important business centre in western India. A large number of textile mills and other industries are located in and around Ahmedabad. Wellknown educational and research institutions like Indian Institute of Management, Indian Institute of Technology (IIT-GN), Physical Research Laboratory (PRL), Ahmedabad Textile Industries Research Association (ATIRA), National Institute of Design (NID), Space Applications Centre (SAC/ISRO), Institute of Plasma Research (IPR), Centre for Environment Planning and Technology (CEPT) etc. are located here in addition to many universities like Gujarat University, Gujarat Technical University, Gujarat Vidyapeeth, Nirma University etc.

The famous Sabarmati Ashram, from where Mahatma Gandhi, Father of the Nation organized the non-violent movement during India's freedom struggle, is also situated

here. The other places to see in and around Ahmedabad are Adalaj step-well, Kankariya lake, Swaminarayan temple, Vechaar - Utensil museum, Auto World – vintage car museum, Sabarmati river front, Science City etc. There are many restaurants, which serve Gujarati, North Indian, South Indian and continental cuisine. The city has many malls, multiplexes and shopping streets.

Ahmedabad is well connected to all important cities of India by air, rail and road. International airports of Delhi and Mumbai are about an hour's flight time from Ahmedabad. A few international flights also touch and originate at Ahmedabad.

The 9-day dance festival of Garba (Oct-Nov), the light and cracker festival of Diwali, the kite festival of Makar Sankranti (14 Jan) and the colour festival of Holi (March) are occasions to enjoy in Ahmedabad. Summers from April to June are very hot. Rainfall in the area is moderate. The weather is pleasant during November to March.





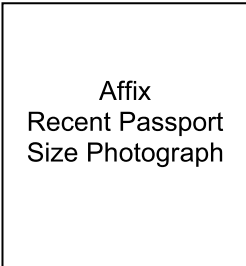
**CENTRE FOR SPACE SCIENCE AND TECHNOLOGY EDUCATION
IN ASIA AND THE PACIFIC**
(AFFILIATED TO THE UNITED NATIONS)

**APPLICATION FORM FOR THIRD POST GRADUATE COURSE IN
“GLOBAL NAVIGATION SATELLITE SYSTEMS”**

August 1, 2019 to April 30, 2020

at

Space Applications Centre, Ahmedabad, India
Last date for receipt of application: April 15, 2019



GNSS - 3

(for office use only)

Application No:

Date Received:

(Please type or use **CAPITAL LETTERS**)

- 1. Name (Dr/Mr/Mrs/Miss):
(As mentioned in the Passport)
- 2. Father's Name: 3. Name of mother/husband/wife:
- 4. Date of Birth (DD/MM/YYYY): 5. Place of Birth:
- 6. Gender (Male/Female): 7. Nationality:
- 8. Present Contact Information: (Include Organization Name, Head of the Organization, Complete Address etc.):
.....
.....
.....

Contact Numbers: (Please give complete Phone No. with **country, city codes**)

Home: Office: Mobile:

Fax: E-mail:

Important:

- a) Interested persons may detach last 4 pages from this brochure and use them as Application Form.
- b) Full passport details must be mentioned in the Application Form or provided to the Centre at the earliest possible.
- c) Application Forms without passport details may not be considered.
- d) Providing alternate email-id would ensure timely communication with applicants.
- e) Please note, for faster communication with the applicants, CSSTEAP Secretariat will be using your email-id for all purposes (e.g. admission letter, air tickets and logistic arrangement).

- 9. Permanent Home Address (in your country):
.....
.....

Contact Numbers: (Please give complete Phone No. with **country, city codes**)

Telephone: Mobile No:

Fax: E-Mail (alternate, preferably G-mail or Yahoo):

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10. Nearest International Airport (Specify the place/city):

11. ACADEMIC QUALIFICATIONS:

Degree/(Bachelor/ Master)/ Diploma/School	Normal Duration of Course (mention from which year to year)	University/ Institution Name	Year of passing	Grade/ Percentage	Major subjects/ specialization

(Enclose copies of Degree/Diploma/Certificates/marks/grades etc. obtained and their certified translation in English)

Major subjects in last examination:

Area of Specialization:

Medium of Instruction/Language: TOEFL Score:

Proficiency in English – tick (✓) in appropriate item below:

- Reading: Fair, Good, Very Good, Excellent
- Writing: Fair, Good, Very Good, Excellent
- Spoken: Fair, Good, Very Good, Excellent

(Enclose certified copies of marks/grades of degree, diploma, TOEFL (validity period) etc. certificates and their certified translation in English)

12. DETAILS OF EXPERIENCE:

(a) Present Position:

Present Responsibilities:

Organisation and Complete Address:

.....

Date of joining this Organisation (dd/mm/yyyy):

* Attach additional sheets giving details of your technical activity during last one year (2017-2018)

(b) Experience during past 5 years:

Name of the Organisation(s)	Position(s)/Post(s) held	Nature of work done	Duration

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13. (a) Activities & Projects in which your present organization is engaged (mandatory) and nature of your duties *

.....
.....
.....
.....

(b) Main Scientific/Technical facilities available in your organization *
(Including approximate number and type of computers, type of software available etc.)

.....
.....

*If required attach separate sheet.

14. Have you done any other course from CSSTEAP? (If 'yes'; please give details including the month & year)

.....
.....

15. How do you foresee, the proposed PG Diploma Course in GNSS will help you?

.....
.....

16. **DETAILS OF PASSPORT:** Please provide valid passport details below and if not holding a valid passport, please forward copy of the passport whenever available.

Passport Number	Place of Issue (City and Country)	Date of Issue	Passport Valid up to	Issuing Authority	Whether previously visited India if so place and date of last visit

17. **PHYSICAL FITNESS:**

- a) Are you suffering from any recurring/chronic/serious communicable disease which may affect your study program in India?
- b) If yes, please specify nature of illness (candidates are advised to attach medical fitness certificate from a government hospital or government recognized hospital on hospital letter head)

18. How do you propose to meet the international travel & stay expenses in India? (preference will be given to those who will make their own travel or both travel and stay arrangement himself/herself)

.....
.....

19. **DECLARATION BY THE CANDIDATE:**

I have read the announcement brochure and will abide by the rules and regulations of the Centre. I have made/ am making/ have not made travel arrangements for attending the course and local expenses for the period of stay in India.

Date:

Place:

Signature of Candidate

20. SPONSORING / NOMINATING / ENDORSING AGENCY CERTIFICATE:

Dr./Mr./Ms.....is sponsored/endorsed by to attend the **Third Post Graduate Course in "Global Navigation Satellite System"** to be held at Space Applications Centre, Ahmedabad, India during August 1, 2019 – April 30, 2020. We envisage to utilize his/her experience in specific tasks of our organization/agency. The candidate will be allowed to report back to the organization and carryout the project work for a period of one year after his/ her return to this country and will be provided with all the facilities required for the same. Following statements are mandatory for certification by the sponsor.

- a) He/She will be/will not be provided international travel support.
- b) He/She will be/will not be provided financial assistance for the period of stay in Indi
- c) He/She possesses adequate knowledge of English Language required for the course.

(Mandatory Please tick appropriate option)

Date:	Signature:
Place:	Name in Capital Letters:
	Designation:
	Phone No:
	Fax No:
	Email:
(Official Seal of the sponsoring or nominating authority)	
Note: Application without official seal of sponsoring or nomination authority and their details will not be considered.	

21. FORWARDING NOTE BY THE RESPECTIVE INDIAN EMBASSY/HIGH COMMISSION IN YOUR COUNTRY OR YOUR EMBASSY/HIGH COMMISSION IN INDIA, NEW DELHI

This is to forward the application of Dr./Mr./Ms. of (Specify the Country Name here) for the 9 months Post Graduate Course in GNSS - 3 of CSSTEAP to be held at Space Applications Centre, Ahmedabad, India during August 1, 2019 – April 30, 2020.

Date:	Signature
Place:	Name:
	Designation:
	Phone No:
	Fax No:

(Official Seal of the Embassy/High Commission)

Note: **Application without official seal** of the Embassy or High Commission will not be considered.

N.B. Please send an advance copy of the application form duly signed by the nominating or sponsoring agency to the Course Director, GNSS - 3, CSSTEAP, Space Application Centre, ISRO, Ahmedabad, India by fax (+91-79-26915807) or Email to cssteapgnss@sac.isro.gov.in for quick processing. Original copy to be sent through Indian Embassy/High Commission of your country after duly signed the sponsor or through your Embassy/High Commission in New Delhi, India.

IMPORTANT

- The Application which is not complete in all respects is likely to be rejected.
- Candidates must attach copies of certificates of:
 - a. Medical fitness to attend the course including Chest X-ray (PA), Blood Test (including Random Blood Sugar, HIV, HBs, Ag), Urine complete (in case any medical information requiring attention is hidden and if found during the course, the centre will be compelled to send the candidate back home at the cost of nominating agency or candidate).
 - b. Attach copy of Highest degree obtained (Degree certificate and marks sheet/grade card)
 - c. Proof of Proficiency in English needs to be provided or certificate provided by the nominating agency.
 - d. Attach copy of All Degree Certificates, if not in English, may please be translated in English and attested by the Head of the organization or transcript in English can also be submitted.
- **Expecting mothers are advised to take a judicious decision before applying and joining the course. Please indicate this information in application form.**
- Smoking and consuming alcoholic drinks in class room and office campus is prohibited.

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IMPORTANT DATES FOR GNSS - 3 COURSE

Last date for Receipt of Applications	April 15, 2019
Information of Selection	May 15, 2019
Commencement of Course	August 1, 2019
Completion of Phase-I (in India)	April 30, 2020

Mail the application form on the address given below through Governing Board member (list on inside of the front cover page of this brochure) to Indian Embassy/High Commission in your country.

To,

Course Director, GNSS-3,
CSSTEAP
Room No:33, Building No:24A
Space Applications Centre,
Indian Space Research Organisation
Ambawadi Vistar P.O.,
AHMEDABAD - 380 015 - Gujarat (INDIA)
Phone : +91 - 79 - 2691 2433/2427
Fax : +91 - 79 - 2691 5807
Email : cssteapgnss@sac.isro.gov.in

Note: You are requested to directly e-mail a scan copy of the application form signed by the nominating organisation, to cssteapgnss@sac.isro.gov.in for taking necessary advance action.





HEADQUARTERS

IIRS Campus
4, Kalidas Road
Dehradun- 248 001 (INDIA)
Tel: +91-135-2740737 & 2740787
Fax: +91-135- 2740785
Email: cssteap@iirs.gov.in
Website: www.cssteap.org

IIRS CAMPUS

Indian Institute of Remote Sensing
No. 4, Kalidas Road
Dehradun- 248 001 (INDIA)
Tel: +91-135-2744 583
Fax: +91-135-2741 987

SAC CAMPUS

Space Applications Centre
Ambawadi Vistar P.O.
Jodhpur Tekra
Ahmedabad- 380 015 (INDIA)
Tel: +91-79-2691 3344
Fax: +91-79-2691 5843

PRL CAMPUS

Physical Research Laboratory
Navrangpura
Ahmedabad- 380 009 (INDIA)
Tel: +91-79-26314759
Fax: +91-79-2630 2275

URSC CAMPUS

U R Rao Satellite Centre
Vimanpura Post
Bengaluru- 560017 (INDIA)
Tel: +91-80-25084383
Fax: +91-80-25084477

DELHI OFFICE

Department of Space
Lok Nayak Bhawan
3rd floor, Khan Market
New Delhi- 110 003 (INDIA)
Tel: +91-11-2469 4745
Fax: +91-11-24693871