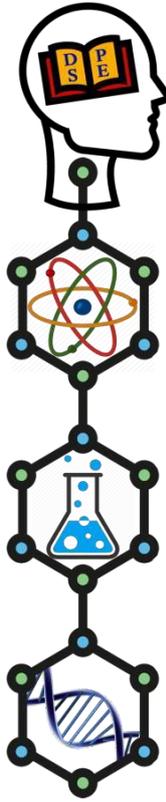


Programme Guide



विद्यया ऽ मृतमश्नुते



एन सी ई आर टी
NCERT

NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

NEW DELHI

Contributors	
Prof. P. C. Agarwal Principal RIE, Bhubaneswar	Prof. Manasi Goswami Professor of Physics RIE, Bhubaneswar
Dr. Bhupati Chakrabarti Former Professor of Physics City College, Kolkata	Prof. I. P. Gowramma Professor of Education RIE, Bhubaneswar
Prof. M. K. Satapathy Head, DEE RIE, Bhubaneswar	Prof. S. C. Garg Former Pro V.C. IGNOU, New Delhi
Prof. B. N. Panda Dean (Research) RIE, Bhubaneswar	Dr. C. K. Ghosh Former Director NCIDE, IGNOU, New Delhi
Prof. Sabita P. Patnaik Former Principal RIE, Bhubaneswar	Mr. R. R. Koireng Curriculum Group NIE, NCERT, New Delhi
Prof. A. K. Mohapatra Professor of Zoology RIE, Bhubaneswar	Prof. Rama Chandra Mohanty Professor of Botany (Retd.) Utkal University, Bhubaneswar
Prof. D. L. Dash Professor of Zoology RIE, Bhubaneswar	Mr. Gouri Sankar Mahapatra Principal (Retd.) Chauliaganja Matha Sahi, Cuttack
Dr. Anshumala Gupta A-9, Tower-9 New Moti Bagh, Delhi	Late Prof. Madhuri Mahapatra Professor of Physics RIE, Bhubaneswar
Dr. Binodini Pradhan Asso. Professor, Rama Devi Women's University, Bhubaneswar	Dr. Dhanya Krishnan Asst. Professor in Education RIE, Bhubaneswar
Dr. Aerum Khan Asst. Professor, IASE Jamia Millia Islamia, Delhi	Dr. Ramakanta Mohalik Professor of Education RIE, Bhubaneswar
Mr. Akhileswar Mishra Headmaster, DM School RIE, Bhubaneswar	Prof. L.D. Behera Professor of Education RIE, Bhubaneswar
Mr. J. Praharaj DM School RIE, Bhubaneswar	Mr. A. K. Jena DM School RIE, Bhubaneswar
Programme Coordinator	
Prof. Manasi Goswami	Joint Programme Coordinator
Prof. I. P. Gowramma	
Cover and Layout Designed by	
Taruna Kumar Sahu Omm Officemax	

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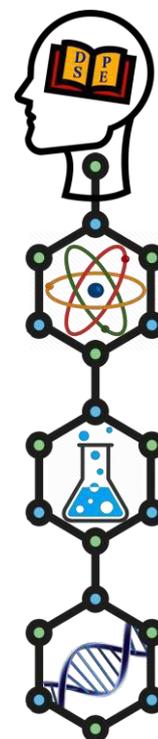
1. Introduction to the Programme

This Programme aims to train in-service science teachers (both trained and untrained), aspiring teachers, science teacher educators, science education researchers for enrichment of their professional competences as well as enhancement of their academic careers. The participants of this Programme will henceforth be referred to as Trainees.

In order to make the programme accessible to a large number of aspirants, it has been offered in the blended mode with components of distance, online and face-to-face interaction to enable the trainees to avail themselves of the opportunity without leaving their respective places of work and families for long time. The programme will help the trainees to prepare for teaching job/upgrade their professional competencies while at job or take up research in science education. The science teachers and science teacher educators individually or from Teacher Education Institutions (TEIs) would be able to make use of the programme to meet teacher education needs at secondary level.

Some Unique Features of the Programme are:

- (i) **Focus on Needs of Indian Teachers**
The Programme aims to meet the needs of Indian science teachers at secondary level, particularly in content analysis, pedagogy, process-oriented teaching, outcome-based teaching and adopting teaching as a journey to research.
- (ii) **Opportunity for Culturally Responsive Science Education**
The Programme provides opportunities to develop multicultural and contextual perspectives through various inputs.
- (iii) **Exposure to ICTs in Teaching**
The Programme emphasises Technological Pedagogical Content Knowledge (TPCK) so that trainees become resilient, accommodative and receptive to technology.
- (iv) **Teacher as a Researcher**
The Programme strives to make the trainees appreciate that research and teaching are complementary to each other and research investigation enhances capacity and competency. The inbuilt research component of the programme is an indispensable element for self-motivation to teach science.
- (v) **Extension / Holistic Approach / Scientific Temper**
The Programme lays emphasis on the extension dimension of scientific knowledge and scientific literacy by exposing the trainees to real life situations. A holistic approach towards science education has been taken as far as interdisciplinary nature of science is concerned. It is also in conformity with Article 51(A), Clause-H of the Constitution of India regarding Duty of a Citizen by the process of inculcation of scientific temper and recommendations of NEP-2020.



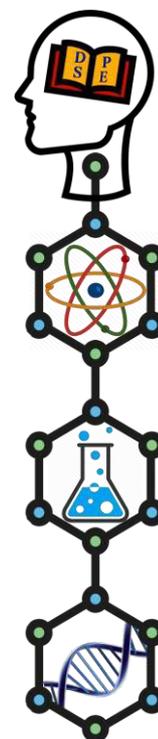
- (vi) **Blended Mode:** This programme is being offered in blended mode where technology plays an important role of intermediary in the teaching-learning process. It is envisaged to provide interaction, which is essence of higher education and training, through face-to-face contact as well as ICT resources.

Study Centres with Addresses

We now present through a Table the list of Study Centres with their addresses and jurisdictions.

TABLE PG1 : Study Centres

SL No.	Study Centre Address	Centre Code	States / UTs Covered
01.	Head, Department of Education in Science and Mathematics (DESM), NCERT, Sri Aurobindo Marg, New Delhi-110016 Phone: +91-11-26561742 E-mail: desm.nie.ncert@gmail.com	01	Delhi-NCR (viz., Delhi, Gurgaon, Faridabad, Noida, Ghaziabad and other surrounding areas) Chandigarh
02.	Principal, Regional Institute of Education, Capt. D.P. Choudhary Marg, Ajmer – 305 004 Phone: +91-145-2643671 E-mail: rieajmer@yahoo.com	02	Jammu and Kashmir, Haryana, Himachal Pradesh, Punjab, Rajasthan, Uttarakhand, Uttar Pradesh and Ladakh
03.	Principal, Regional Institute of Education, Shyamala Hills, Bhopal -462002 Phone : +91-755-25522001 E-mail: riebpl@gmail.com	03	Chhattisgarh, Dadra and Nagar, Haveli Daman and Diu, Goa, Gujarat, Madhya Pradesh and Maharashtra
04.	Principal, Regional Institute of Education, Sachivalaya Marg, Bhubaneswar -751022 Phone :+91-674-2541409 E-mail: riebs@nic.in	04	Bihar, Jharkhand, Odisha and West Bengal, Andaman and Nicobar Islands
05.	Principal, Regional Institute of Education, Mysuru – 570006 Phone : +91-821-2514095 E-mail: riemysore@rediffmail.com	05	Andhra Pradesh, Karnataka, Kerala, Lakshadweep, Puducherry, Tamil Nadu and Telangana
06.	Principal, North East Regional Institute of Education (NERIE), NCERT, Umiam, Barapani, Shillong – 793103 Phone : +91-364-2570009 Email: nerie.ncert1@gmail.com	06	Arunachal Pradesh, Assam, Manipur, Meghalaya, Sikkim, Nagaland, Tripura and Mizoram



Each Study Centre will have Coordinator(s) who will be responsible for the overall supervision of conduction of the Programme at that Centre.

Eligibility

Essential : Any Science Graduate (with : Physics, Chemistry and *Biology or any branch of Life Sciences as subjects of study at +2 level)

Desirable :

- (i) In-service (in-service does not mean only teaching jobs) Graduates or Post Graduates in Science with experience of teaching at Elementary / Secondary Level.
- (ii) Not in service – Graduates or Post Graduates, PG students as prospective teachers in science.
- (iii) Science Graduates & Post Graduates with B.Ed, M.Ed, and M.A(Education) interested in undertaking research in Science Education.
- (iv) Graduate or Post Graduate Teacher Educators of Science.

Number of Seats

The maximum number of seats at each centre is 50 (fifty). Reservation of seats for different categories will be applicable as per the Government of India rules.

Duration

The duration of the Programme is one year, spread over two semesters. Each semester has 2 (two) phases. Minimum time to complete the Programme is one year and maximum time to complete the Programme is two years.

TABLE PG2 : Semester wise break-up activities

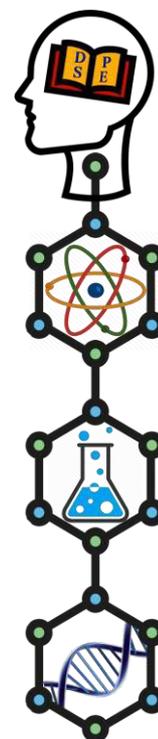
Semester	Phase	Details
Semester – I	I	Guided Self-learning
	II	Assignments / Practical / Contact /Assessment and Evaluation
Semester – II	III	Guided Self-learning
	IV	Assignments / Projects / Practical / Contact /Assessment and Evaluation

Medium of Instruction

The medium of instruction is **English**. However, the learner can take their teaching assignment in schools in any medium (regional language) but will have to submit the report in English/Hindi.

Admission Procedure

Candidates desirous of seeking admission in the Programme will be required to fill in the prescribed application form. The form should be downloaded well before the last date of submission from the NCERT website (www.ncert.nic.in) or from the respective RIE websites after the advertisement. The form has to be submitted online as well as in hardcopy. After filling the application form, please take its print out and sent to the study centre under whose jurisdiction your residential/working place falls. You should refer to the addresses of the Study Centres and their respective jurisdictions (refer to Table PG1). A deputed candidate should submit



her/his application through proper channel. Getting the deputation from the competent authority is the solely your responsibility and *the study centre will not be responsible for this in any way.*

Applications complete in all respects should be submitted electronically within the last date mentioned in the advertisement to the study centre chosen by you.

A printed version of the electronically submitted application form along with the self-attested copies of marks /grade sheets /degrees/certificates in support of qualifications and work experience should be sent to the study centre concerned by Speed Post.

Screening will be done according to the criteria laid down by the NCERT/. Eligible candidates may be called for a selection test at the RIEs/NIE. Travel and stay arrangements of outstation candidates will have to be done at the candidates themselves at their own expense. List of selected candidates will be notified on the website. Selected candidates are required to get their certificates / documents verified against the originals at their respective study centres within the time stipulated in the selection list.

The admission remains valid for a period of two years from the date of admission.





2. Curriculum Formulation

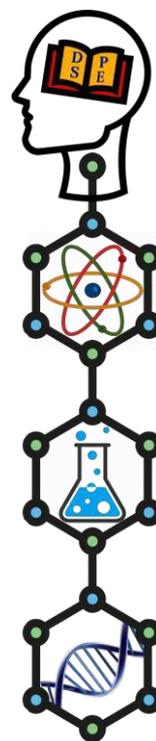
The Programme structure, content, pedagogy, evaluation and other related activities have been identified for a trainee towards fulfilling her/his objectives of performing as a secondary level science teacher, evaluator, teacher educator, researcher in science education. Before going into the Programme structure and contents, you are advised to go through theoretical, philosophical and psychological basis of the Programme. The curriculum is structured on the contextual and contemporary needs of secondary level school science.

Rationale

Science Education is closely related to the dynamic variation of curricular framework of school education. But experience shows that both pre/in-service teacher training programmes are not synchronized or tuned to such changes. Moreover, changes in teaching-learning strategies of science are so rapid and it is important to design a curriculum keeping pace with all such requirements. This is in conformity with the National Education Policy-2020 (NEP-2020), which states that “Teachers will be given continuous opportunities for self-improvement and to learn the latest innovations and advances in their profession”. In this context, such short duration programmes are expected to be highly beneficial for upgrading the existing knowledge and skills to unleash the energy of our youth. Such programmes can accommodate the new realities and challenges easily and serve as supplementary to the mainstream training programmes. When teachers volunteer for such programmes, they develop the ownership for these. In a recent need assessment exercise, most of the teachers opined that if training is integrated with their own job/ profession, they can happily incorporate those elements in their teaching. Hence, it is highly imperative that well designed programmes, such as this, enhance their continuous professional development. Teachers, non-teachers, untrained teachers and researchers can benefit by opting for a few such short duration programmes.

Following considerations have also guided the formulation of the curriculum of DPS:

- (i) The syllabus covering theory and practical programmes has been designed keeping in view the professional standards laid down for entry into the occupation and other essential activities related to science teaching-learning.
- (ii) The programme has been developed with self-check exercises so that doubts / confusion / dilemma / alternative conceptions can be addressed easily.
- (iii) The hands-on experiments prescribed in the syllabus related to secondary level school science can be easily conducted at any school. Alternatively, the experimental set up can be assembled through low cost, affordable and easily available materials.



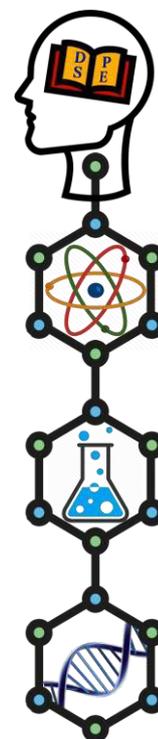
- (iv) Content analysis, pedagogical content knowledge, simple applications of ICT resources for teaching–learning of science, selection of appropriate media and technologies, development of simple ICT resources like audio/video, taking digital photographs, smart phone/web Apps, are some of the key features for the success in the programme.
- (v) The syllabus and materials of the programme have been developed in consultation with a team of multidisciplinary experts comprising teachers, teacher educators and course designers with long experience in science education, during a series of workshops held for the purpose.
- (vi) Contact programmes have been designed to help trainees to study more at their workplace at their own pace to realize, concentrate, apply and reflect on their own learning.
- (vii) The curriculum has been designed based on need assessment done with the secondary level students and teachers.

Understanding Science Education, Science Teaching and Aptitude of Students at Secondary Level

The social imperatives of education and specially science education have been attributed great importance and urgency in NEP 2020. The long standing problems as well as emerging social issues present challenges in science curriculum and pedagogy of science teaching. Teachers sometimes tend to mask their limitations and possibly lose interest to face the challenging classroom situations. The study materials of the DPSE are so designed that these provide appropriate direction and right answers to queries hitherto unexpressed. Besides, the interactions envisaged should help them assess their own understanding and knowledge and reflect on their own performance without any inhibition. Any science graduate or post graduate aspiring for a career in science teaching or getting involved in various activities of science education can easily opt for this Programme.

It is well known that, teaching and research mutually supporting. This Programme strives to provide this orientation and help in capacity and competency building of trainees. As a matter of fact, research in science education is a big activity these days. Therefore a well designed programme such as this can establish a base for research in science education. Any research scholar can opt for this Programme to get acquainted with the basics of Science Education Research (SER). Those involved in science teaching or development of teaching-learning materials in an un-organized / private sector can also derive benefit from this Programme.

Teaching is a two-way interaction between the students and the teachers. And effectiveness of teaching as well as learning is highly influenced by social, cognitive, emotional, cultural and philosophical elements. One of the main facets of science education is understanding the Nature of Science (NOS). It includes knowledge of the scientific worldview. From time to time new standards and pedagogical strategies have been evolved by each nation to face the challenges of sustainable science education. These standards also describe what students should know about science and be able to do on completion of secondary education.

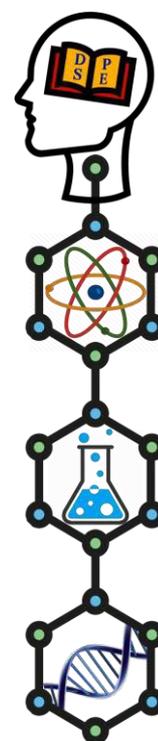


India is a country with huge population and diversified socio-economic conditions. It is also a land of diversity in culture and language. Hence, bringing such a vast country under the single umbrella of a monolithic standard of science education is an uphill task. It is well accepted that so many untrained teachers are engaged in government and private schools for science teaching. The training programmes for teachers and teacher educators in India are somehow not uniformly designed. Moreover, one-time pre-service programmes are not enough to prepare a strong base of school science education. Short term in-service training programmes do not seem to be ideally effective. That is, trainees are, in general, not able to utilize the benefits of their training when they go back to their respective workplaces. This Diploma Programme is an attempt to overcome such limitations.

Development of Professional Competencies

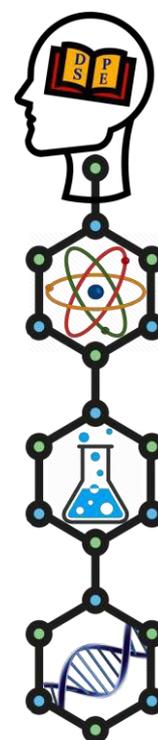
The Programme will help all stakeholders to acquire the following competencies and enrich their professional careers.

- Develop understanding of concepts, principles, theories and laws governing the physical and biological world, consistent with the stages of cognitive development.
- Develop ability to acquire and use the method of science. This includes observing; questioning; planning investigations; hypothesizing; collecting relevant samples and preserving them in pure forms, comparing and grouping, analyzing and interpreting data obtained from different sources.
- Draw scientific inferences and provide explanations with evidences and justifications while thinking critically to address and evaluate alternative explanations.
- Conduct experiments, in and out of the laboratory involving both qualitative and quantitative interventions, reason out the results and findings.
- Develop lab skills and assessment of learning outcomes relevant to the same.
- Guide and help the trainees to perform experiments to explore different aspects of science and relate them to their daily lives/new situations.
- Appreciate how concepts of science evolve with time.
- Develop scientific temper (objectivity, critical thinking, freedom from fear, prejudices and superstitions, etc.)
- Nurture curiosity, aesthetic sense and creativity.
- Seek fun and enjoyment in doing science.
- Encourage skills of collaborative and cooperative learning.
- Identify areas for Science Education Research (SER).
- Achieve competence in organizing and conducting small field surveys with students.
- Imbibe the values of cooperation, concern and scientific integrity.
- Develop skills of listening, reading, writing and speaking science.
- Develop respect for human dignity and rights, equity and equality.



SER related competencies may include

- Orientation towards Experiential Learning and Action Research.
- Analysis of contents and activities suggested in science textbooks vis-à-vis resources available.
- Matching cognitive demands of the contents of textbooks with cognitive levels of learners.
- Identifying pupil's alternative conceptions and addressing them.
- Observing and addressing the issues related to communication and language among pupils, in the science textbooks and in the classroom transactions.
- Designing and trying out ways of collecting open ended questions from pupils.
- Framing probing questions/questionnaire.
- Designing a pilot study
- Examining available research tools and their suitability and adaptability to the situation under study.
 - Collecting data related to skills such as tool design, data collection, analysis and interpretation.
- Research skills such as critical reading and review of a standard research paper.
- Searching internet/online journals for a new field of research, referencing, relevant information, data etc.
- Writing a research paper and examining its comprehensibility.
- Citation from the work of other researchers with due acknowledgement.
- Selecting appropriate journal for publication.
- Using findings of other researchers for enriching own classroom teaching and comparing with own research data.
- Collaborating and networking with peers for conducting research.





3. Programme Structure

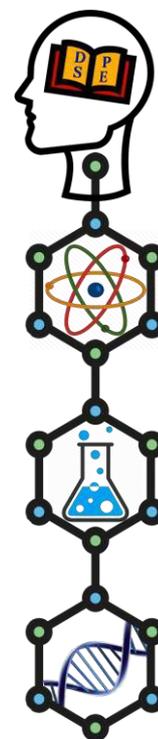
The Diploma Programme in Science Education comprises three components: theoretical instruction, practical work and project. There will be an additional component of school exposure for trainees not having any professional qualification in Teacher Training. The theory component is in line with the basic elements required for training teachers, teacher educators, and researchers in science education. The Programme structure focuses on content analysis, content organization, conceptual clarity, content enrichment and applications of Pedagogical Content Knowledge (PCK) through ICTs and TPCK. It helps in acquiring competencies in process skills for

- learning outcomes,
- principles of approaches to student evaluation,
- outreach programmes/activities,
- self-reflection/motivation/attitudes,
- research methodology,
- teaching as research,
- development of test items,
- research paper writing,
- awareness about online programmes, Massive Open Online Courses (MOOCs) and ICT resources,
- development of professional ethics, and
- programme planning and management.

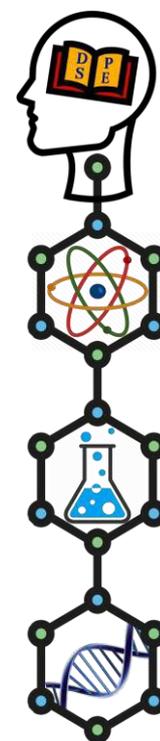
Given below is an overview of the Programme Structure with theory, practical and project components. The details of Project and Practical Courses are given in separate Guides.

Module – I : Basics of Science Education –I	
Unit-1	Evolution of Science
Unit-2	A Broad Perspective of Science Education
Unit-3	Features of Curriculum for School Science Education
Unit-4	Paradigms of Science Education
Unit-5	Pedagogy of Science Teaching-learning
Unit-6	Basic Skills for Science Teaching

Module – II : Basics of Science Education –II	
Unit-7	Planning in Learning Science
Unit-8	Use of ICTs in Learning Science
Unit-9	Activity Based Learning (ABL)
Unit-10	Science Beyond Textbooks
Unit-11	Science Process Skills and Learning Outcomes
Unit-12	Understanding Environment



Module – III : Teaching-learning of Physical Science-I	
Unit-13	Prelude 1: Teaching-learning of Physical Science-I
Unit-14	Prelude 2: Teaching-learning of Physical Science – I
Unit-15	Core Essentials-I : Physical Science
Unit-16	Core Essentials -II : Physical Science
Unit-17	Core Essentials -III : Physical Science
Unit-18	Core Essentials -IV : Physical Science
Module – IV : Teaching-learning of Biological Science-I	
Unit-19	Prelude 1: Teaching-learning of Biological Science-I
Unit-20	Prelude 2: Teaching-learning of Biological Science-I
Unit-21	Core Essentials-I : Biological Science
Unit-22	Core Essentials -II : Biological Science
Unit-23	Core Essentials -III : Biological Science
Unit-24	Core Essentials -IV : Biological Science
Module –V :Practical Manual	
Module – VI : Teaching-learning of Physical Science-II	
Unit-25	Core Essentials -V : Physical Science
Unit-26	Core Essentials -VI : Physical Science
Unit-27	Core Essentials -VII : Physical Science
Unit-28	Core Essentials -VIII : Physical Science
Unit-29	Dealing with Real Life Situations-I
Unit-30	Dealing with Real Life Situations-II
Module – VII : Teaching-learning of Biological Science-II	
Unit-31	Core Essentials -V : Biological Science
Unit-32	Core Essentials -VI : Biological Science
Unit-33	Core Essentials -VII : Biological Science
Unit-34	Core Essentials -VIII : Biological Science
Unit-35	Dealing with Real Life Situations-I
Unit-36	Dealing with Real Life Situations-II
Module –VIII : Assessments and Evaluations	
Unit-37	Assessments and Evaluations in Learning Science
Unit-38	Dimensions and Levels of Learning
Unit-39	Assessment and Evaluation Tools – I
Unit-40	Assessment and Evaluation Tools - II
Unit-41	Statistical Analysis of Evaluation Data
Module –IX : Science Education Research	
Unit-42	Needs for Science Education Research (SER)
Unit-43	Evolution of Science Education Research
Unit-44	Areas in Science Education Research (SER)
Unit-45	Conducting Research in Science Education
Unit-46	Quantitative and Qualitative Research in Science Education
Module – X: Project Guide	





4. Study Materials

The Programme uses print and ICT resources as tools of instruction.

Printed Modules

Print materials in the form of self-learning modules are the mainstay of this Programme. This study material in self-learning format has been prepared by eminent experts from within NCERT and from outside with long standing experience in teaching science, preparation of teachers and teacher educators, science education research and programme designing. The preparation of materials has been an extensive exercise undertaken by a team of experts pooled by RIE, Bhubaneswar, NCERT, India.

The distinctive feature of the print materials is simple and easy to comprehend language. The teacher has been built in the text to encourage the trainees for self-study.

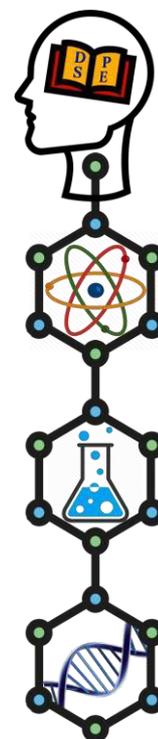
In all there are 46 Units* across eight (out of a total of eleven) Modules*. In addition, there is a Programme Guide, Practical Manual and a Project Guide. The material will be given to the enrolled trainees in two phases, one for each semester as tabulated below.

(* The terms 'Units' and 'Modules' do not connote to online courses. It is imperative that when this Programme gets launched online, the nomenclature will undergo changes conforming to MOOCs)

Courses in Semester – I

Science Teaching-learning- I

Code	Module Title	No. of Units
Module-I	Basics of Science Education–I	6
Module-II	Basics of Science Education–II	6
Module-III	Teaching-learning of Physical Science-I	6
Module-IV	Teaching-learning of Biological Science-I	6
Module- V	Practical Manual	One manual for 2** Semesters
Total	Five Modules	24 Units plus one Manual



Courses in Semester – II

Science Teaching–learning-II

Code	Module Title	No. of Units
Module-VI	Teaching-learning of Physical Science-II	6
Module-VII	Teaching-learning of Biological Science-II	6
Module-VIII	Assessment and Evaluation	5
Module-IX	Science Education Research	5
Module –X	Project Guide	One Guide**
Total	Six Modules	22 Units plus one Guide

***The Practical Manual serves as Modules V and Project Guide contains all necessary instructions as Module X.*

At the beginning of Semester I, the trainees will receive the following print materials:-

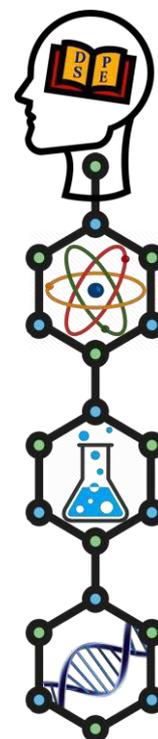
- (i) Programme Guide containing general guidelines and rules, information about the programme structure, curriculum and syllabi, procedure for transaction of the programme and evaluation.
- (ii) 4 Modules having 24 Units of theory content
- (iii) Practical Manual
- (iv) Project Guide
- (v) Contact Programme Guide
- (vi) Extended Contact Program Guide***

At the beginning of Semester –II the trainees will receive the following printed materials:-

- (vii) 4 Modules having 22 Units of theory content.

****Trainees not having professional teacher training qualification will have to undergo an Extended Contact Programme (ECP), for which a separate notification will be sent. The trainees concerned will receive necessary instructions regarding the conduct of ECP during the Induction Session.*

Each module (M1 to MIV and MVI to MIX) consists of five or six units which have been detailed in Chapter-8 of Programme Guide. Units in each module have been arranged in a logical sequence on the basis of conceptual/thematic linkages. Therefore, it is suggested that the trainees follow the sequence all along. Although the study material is self-explanatory and self-guiding, some doubts and queries may still persist in the minds of trainees. To facilitate their learning and ensure academic



progression, it each trainee will be attached with a mentor. The mentor can be contacted for clarification of doubts and queries, if any, through e-mail/post/telephone.

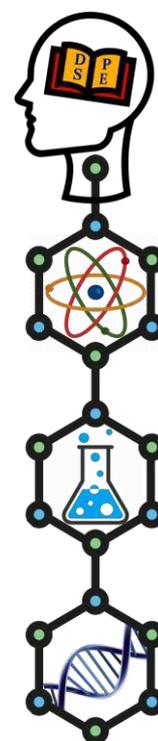
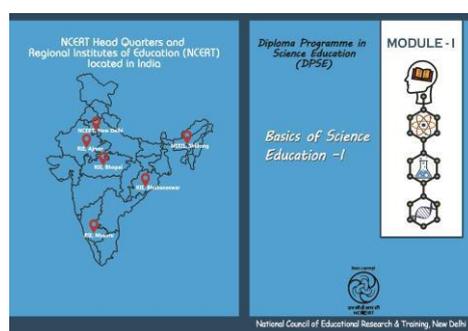
The Practical Manual contains guidelines for practical work to be undertaken by the trainees in two semesters at their workplace or at home. Similarly the Project Guide contains all instructions for the trainee regarding the project work for two semesters. The Contact Programme spread over 21 days will be conducted in the Face-to-Face mode. All the trainees will have to compulsorily attend the CP at their respective study centre. These 21 days have been spread over four phases; two during each semester of (3+5) and (5+8) days.

ICT Resources

We are living in knowledge era. To enable trainees to appreciate the impact of contemporary realities, they will be exposed to ICT resources to supplement the print materials and reinforce the concepts and their applications.

Assignments

One assignment per semester will be sent to all trainees. Detailed instructions will also be provided for doing each assignment along with a schedule for its submission. Feedback on assignment responses will be provided by the mentors. Timely submission of assignments and their satisfactory completion is mandatory as these will be used for evaluating trainees' performance. Assignment responses must be submitted prior to coming for any phase of the CP. In case a trainee fails to submit the assignment, she/he will not be allowed to join the CP. It is important to highlight that assessment of assignment responses will form a significant component of the total package of evaluation of a trainee.





5. Transaction of the Programme

The Programme will be transacted in the *blended mode* comprising out of campus self study as in distance mode and face-to-face contact during the Contact Programme.

Blended Mode (Distance mode plus Face-to-face Mode)

a. Distance Mode

In the **Distance Mode (off Campus)**, the trainees are expected to acquire comprehension skills of the self-learning materials and answering the self-check exercises. A trainee will learn from the teacher in-built in the course materials.

Practical

Practical is an integral component of every science programme. Likewise, DPSE also has a significant hands-on component in this Programme. Trainees will have to do Practical in both semesters. The experiments are so planned that these can be performed at their schools/workplaces or even at their homes. The details about conduct, reporting and evaluation of practical in both semesters are provided through the Practical Manual.

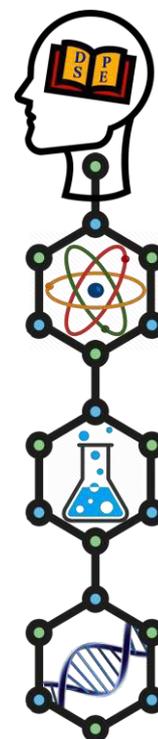
Project

In addition to Theory and hands-on Practical, Project is also an essential component of this Programme. It will help the trainee to prepare themselves for facing real life situations. Project work is to be done in both semesters and the report will have to be submitted during Semester II as per the notified schedule. The trainees are expected to do the Projects based on guidelines provided in the Project Guide.

b. Face-to-Face Mode

In the **Face-to-Face Mode (On Campus Contact Programme)**, the trainees will get opportunity to interact with the coordinators and other resource persons at the study centres for four-fold purposes:

- Clarification of their doubts/queries concerning the content of self-learning materials.
- Reporting about the practical work and submitting the final report thereof.
- Discussion and presentation about the projects and submission of final report thereof.
- Appearing in Theory Examinations and attending Grand Viva-voce.



The contact programme will be organized phase-wise at the study centre for a total period of **twenty-one** days. Trainees will be informed about the exact dates of the contact programme in advance so that they can plan the logistics accordingly. Joining the contact programme by a trainee will be subject to her/his satisfactory submission/completion of assignments. For each phase of contact programme, every outstation trainee should preferably stay near the study centre for ease of commutation.

Before coming to the contact programme, a trainee will receive detailed instructions about the prior activities she/he is expected to undertake. These will mainly be about the following:

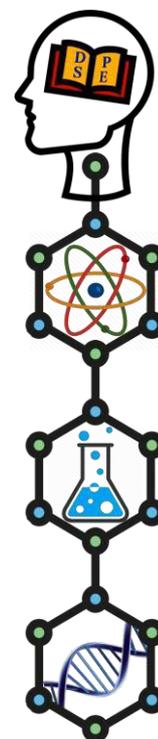
- Skills of Microteaching
- Open Ended Experiments
- Activity Based Teaching
- Topics for Group Discussion on SER and Project.
- Textbook Analysis
- Test Item Development

This list is not exhaustive. It is meant for giving a trainee some feel about the pre-contact programme activities.

Trainees will also be required to bring the study materials, teaching aids / models etc. developed by them and the portfolio of the activities maintained by them. They may also bring with them self-developed and self-collected e-resources to facilitate their own presentations. The time of the contact programme will be from 09.30 AM to 05.30 PM with breaks for lunch and tea on each of the twenty one working days.

Maintaining Portfolio:

Every trainee will be required to maintain a record of her/his work on assignments, projects, practical, self-reflection and self-evaluation exercises. Portfolio provides a factual description of a trainee's accomplishments supported by relevant details. The trainee's self-evaluation and self reflection on the work done by her/him and her/his progress in terms of acquiring Knowledge, Skills and Attitude (KSA) should also be included in the portfolio. Each item in the portfolio should be recorded with place, date and time before submission during the Contact Programme.





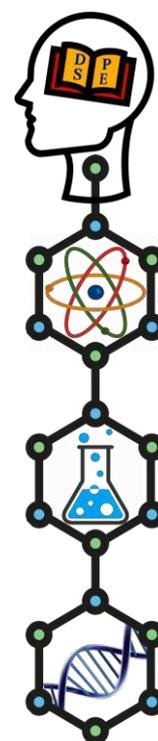
6. Rules and Regulations

The conduct of the Programme will be based on Rules and Regulations as stated under :

- (i) Once a trainee is selected, she/he will have to send acceptance and enroll in the Programme by the due date as per communication from the study centre concerned. If one fails to pursue the Programme after taking admission, or drops out, she/he will have to apply afresh in subsequent years if she/he desires to rejoin the Programme. Programme fees once deposited will not be refunded. However, if a trainee drops out after payment of fee, admission will remain valid for one more year. Thereafter the admission will stand cancelled automatically.
- (ii) If a trainee leaves during or after out of campus phase, she/he will be allowed to carry over the credits earned based on the work completed and submitted for evaluation if she/he rejoins the Programme.
- (iii) Those who leave the Programme during the Contact Programme, will have to repeat it from the beginning and incur all expenses..
- (iv) A trainee is expected to read and complete self-evaluation exercises and activities and maintain a record of these as a part of 'Portfolio Maintenance'. She/he is also required to bring all study materials, completed portfolio, etc. with her/him when coming for the CP.
- (v) If assignments are not completed satisfactorily by a trainee prior to coming for the contact programme, she/he may be asked to join the contact programme in the subsequent year subject to availability of seats.
- (vi) In case of any difficulty, trainees should contact the coordinator(s) of their respective study centre.
- (vii) Any misconduct by a trainee can lead to her/his discontinuation from the programme with immediate effect.
- (viii) If a trainee indulges in any malpractice such as copying of assignments and practical reports, copying in written examination etc., it will be construed as serious misconduct and she/he could be debarred from the Programme.
- (ix) Attendance in all sessions is mandatory during all the phases of the CP.
- (x) It is mandatory to submit all assignment responses, project reports, practical reports, portfolio, etc. within the stipulated timeline, failing which a trainee will be required to repeat the Programme.

The **following rules** will be in force during different phases of the CP. The trainees:

- a. will be required to be at work from 09.00 AM to 05.30 PM with a lunch break from 01.00 PM to 02.00 PM and tea break from 4PM to 4.15 PM;
- b. will observe discipline, punctuality and, regularity;



- c. will seek prior permission of the teacher concerned, if there is an emergency and she/he has to miss any session/class/period. Absence from any session without permission will be treated as absence for the whole day;
- d. will have to complete all the requirements of the supervised practical in order to be eligible for evaluation;
- e. will not be allowed to leave station except in case of exigencies;
- f. will have to take prior written permission of the Programme Coordinator for leaving station in case of exigency;
- g. may be asked to leave the Programme if found indulging in anti-social, anti-national or any other undesirable activities; and
- h. must take 'No Dues' certificate to take the tests during the last phase of the Contract Programme. They have to adhere strictly to the schedule of submission of assignment responses / reports.



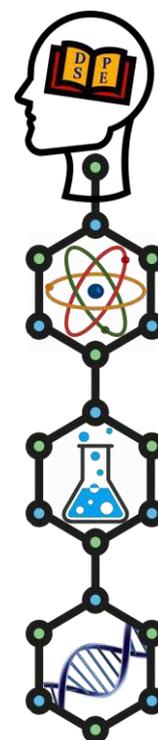
8.

Scheme of Evaluation and Grading

A trainee will be evaluated on all components - Theory, Assignments, Practical, Project -in the Contact Programme. The overall scheme of evaluation, which is based on proportionate credit break-up of the components, is presented in Table PG4. In the subsequent page a prototype of the Grade Sheet is given at Table PG5.

 **Evaluation :Table PG4**

 **Grade Sheet :Table PG5**



C O M P O N E N T S	C R E D I T S	TABLE PG4: Complete Schedule of Execution and Evaluation <i>(‘Total’ means the maximum marks allocated to a particular activity.)</i> Grand Total = 50 + 25 + 12.5 + 12.5 = 100)			SCHEDULE OF TESTS The 21 days of the CP has a break-up as under : 3+5+5+8. The first two days are during the Semester I and other two days during Semester II. Let us call 3,5,5,8 as (a), (b), (c), (d) respectively.	FIVE POINT SCALE for Grades, A,B,C,D,E	CUMULATIVE GRADE POINT AND PASSING GRADE	REMARKS
		MODE OF EVALUATION						
Theory (Th)	16	Two Theory papers, one each in two semesters Marks = (80 + 80) Scaling Factor (SF) = 0.25 160 x 0.25 = 40	Two Assignments, one each in two semesters Marks = (10+10) Scaling Factor (SF)=0.5 20 x 0.5 = 10	Total Marks = 40+10 = 50	I. 80 marks paper during (b) II. 80 marks paper during (d) III. Assignment - 1 during (b) IV. Assignment - 2 during (d)	41-50(A) 31-40(B) 21-30(C) 11-20(D) 01-10(E) 00 (Z)	81-100 (A) 61-80(B) 41-60(C) 21-40(D) 01-20(E) 00 (Z)	All schedules for (b) will be made known during (a) and all schedules for (d) will be made known during (c).
Practical (Pr)	8	Two Practical Exams in two semesters [Marks =30 (Report) + 20 (Viva-Voce)] for each semester SF = 0.5, Total Marks = 50 x 0.5 = 25			Conduct of practical as per Practical Manual at the respective workplaces of the trainees. Reporting and Viva-Voce during (b) and (d)	21-25(A) 16-20(B) 11-15 (c) 06-10(D) 01-05(E) 00 (Z)		
Project (Pj)	4	Project in Semester II Marks = [30(Report) + 20 (Viva-Voce)]. SF=0.25, Total Marks = 50 x 0.25 = 12.5			Working on Projects during Semester I & II at their respective places. Presentation and Viva-Voce during (d)	10-12.5(A) 7.5-10(B) 5-7.5 (c) 2.5-5(D) 1-2.5(E) 00 (Z)	For successful completion, a trainee has to secure at least ‘D’ Grade in each component and at least ‘C’ as the Overall Grade.	The Notifications for (a) and (c) shall be sent separately.
Contact Programme (CP)	4	Grand Viva-Voce at the end of Contact Programme out of 25 marks, SF=0.5, Total Marks = 25 x 0.5 = 12.5			Grand Viva-Voce on overall performance during (d)	10-12.5(A) 7.5-10(B) 5-7.5(C) 2.5-5(D) 1-2.5(E) 00 (Z)		

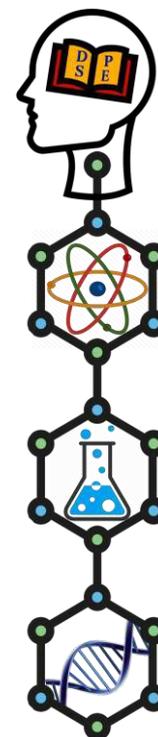
Scaling Factor (SF), Contact Programme (CP), Viva-Voce (VV)

TABLE PG5 : MARK SHEET PROTOTYPE
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING
REGIONAL INSTITUTE OF EDUCATION, _____XXX_____
GRADE SHEET

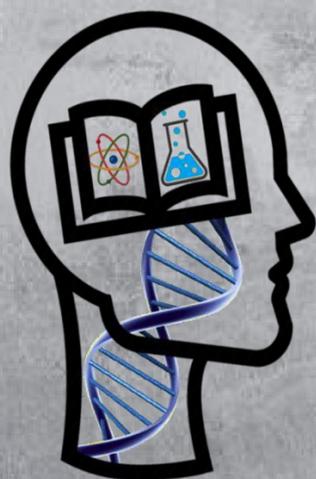
NAME : _____

ENROLMENT NO. _____ ACADEMIC SESSION _____

SL No.	COMPONENTS	STATEMENT OF MARKS / GRADES				OVER ALL MARKS & GD	REMARKS SC/NC
		Max	Secured	Total	GRADES with (SC/NC)		
1	THEORY	Th P-1 (80)	p	$p \times 0.25 = p_1$	$p_1 + q_1 + r_1 + s_1 = T_1$		SC – Successfully Completed
		Th P-2 (80)	q	$q \times 0.25 = q_1$			
		AS -1 (10)	r	$r \times 0.5 = r_1$			
		AS -2 (10)	s	$s \times 0.5 = s_1$			
2	PRACTICAL	PR-1 (30)	u	$u \times 0.5 = u_1$	$u_1 + v_1 + x_1 + y_1 = t_2$ $T_2 = t_2 / 2$	GD	NC – Not Completed
		VV-1 (20)	v	$v \times 0.5 = v_1$			
		PR-2 (30)	x	$x \times 0.5 = x_1$			
		VV-2 (20)	y	$y \times 0.5 = y_1$			
3	PROJECT	PJ R (30)	a	$a \times 0.5 = a_1$	$a_1 + b_1 = t_3$ $T_3 = t_3 / 2$		
		PVV (20)	b	$b \times 0.5 = b_1$			
4	CONTACT PROGRAMME	Grand Viva-Voce (25)	e	$e \times 0.5 = e_1$	$e_1 = T_4$		

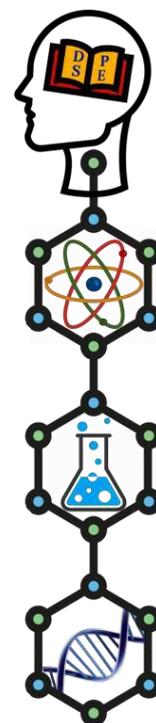


Th-Theory, PR 1 & 2 – Practical Report -1 & 2, PJR – Project Report, AS – Assignment, VV-1 & VV-2 – Practical Viva-voce, PVV – Project Viva-voce, GT – Grand Total, GD – Grade, SC – Successfully Completed, NC – Not Completed



8.

Outline of the Syllabus : Theory



Modules and Guides

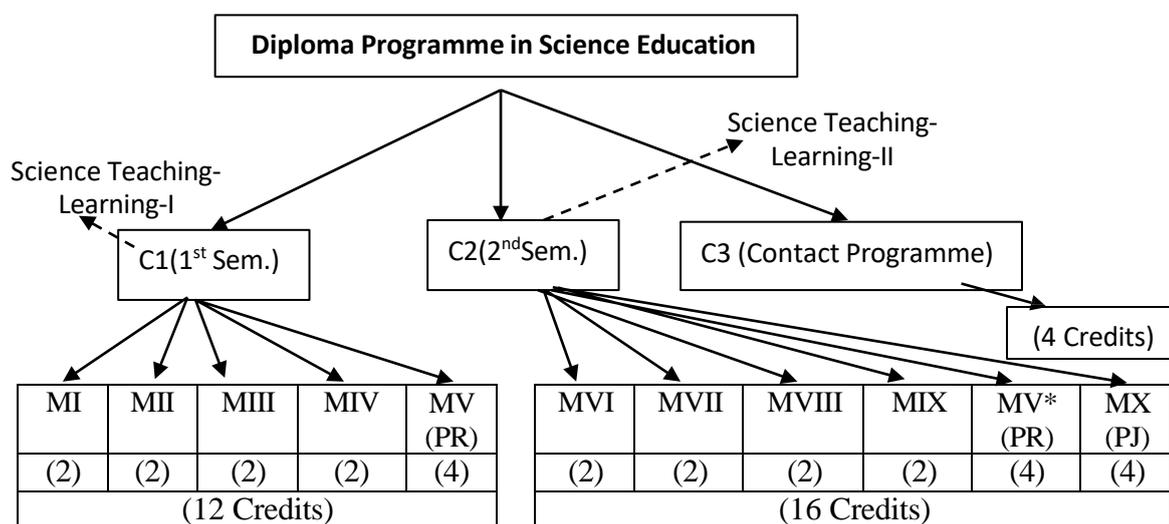
Definition of Credit

One Credit is equivalent to 30 hours of study time for this programme which is inclusive of all learning activities from the point of view of a standard learner.

The total number of credits associated with the Programme is 32.

Each Unit has been designed so as to be covered by a standard learner in five to six hours of reading time. These hours will include reading and comprehension of the contents. An equivalent duration of time is to be spent for answering the CYPs (Check Your Progress), TQs (Terminal Questions), performing the activities given therein, etc. and preparing responses to the Assignments which would be sent separately.

Distribution of Courses (C) and Credits



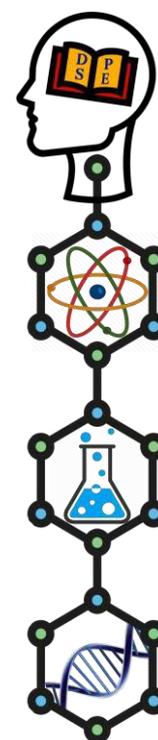
$$\text{Total Credits} = 12 + 16 + 4 = 32$$

C1- Course One, C2 – Course Two, C3 – Contact Programme, M – Module, PR – Practical, PJ – Project

* Module V (MV) appears in both the semesters. There is one Practical Manual covering activities spread over two semesters. The students will get ONE manual and work with it for four credits each in the two semesters.

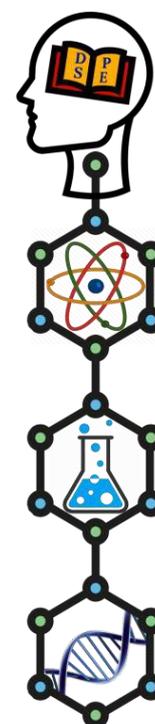
MODULE - I

Module – I : Basics of Science Education –I		Credit
Unit-1	Evolution of Science	2
Unit-2	A Broad Perspective of Science Education	
Unit-3	Features of Curriculum for School Science Education	
Unit-4	Paradigms of Science Education	
Unit-5	Pedagogy of Science Teaching-learning	
Unit-6	Basic Skills for Science Teaching	



Module – I : Basics of Science Education –I				
Units	Title		Duration	
1	Evolution of Science			
	1.1	Introduction <i>Learning Outcomes</i>	15 min.	
	1.2	Philosophy of Science : Historical Perspectives		90 min.
		1.2.1	Science before Galileo	
		1.2.2	Developments in Physical Sciences	
		1.2.3	Developments in Biological Sciences	
	1.3	Agricultural Revolution	30 min.	
	1.4	Emergence of Technology		100 min.
		1.4.1	Industrial Revolution	
		1.4.2	Grey Revolution	
		1.4.3	Communication Revolution	
		1.4.4	Exploration of Space	
	1.5	Science, Technology and Society	30 min.	
1.6	Let Us Sum Up	10 min.		
1.7	Terminal Questions	10 min.		
1.8	Solutions, Hints, Answers, References and Further Readings	15 min.		

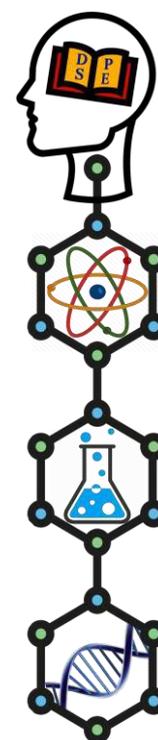
Units	Title		Duration	
2	A Broad Perspective of Science Education			
	2.1	Introduction <i>Learning Outcomes</i>	15 min.	
	2.2	The Four Pillars of Education	60 min.	
	2.3	Extended forms of Science Education: STEM and STEAM	20 min.	
	2.4	Interdisciplinary Nature of Science		40 min.
		2.4.1	Interdependence of the Disciplines of Science	
		2.4.2	A Look at School Science in Practice Today	
	2.5	Real-life Examples of Interdependence		40 min.
		2.5.1	Cardiovascular System and Physics	
		2.5.2	Vision and Physics	
		2.5.3	Mathematical Formula of Beauty	
	2.6	Precision and Accuracy in Science	30 min.	
	2.7	Science and Values		50 min.
		2.7.1	Scientists and Values	
2.7.2		Teachers and Values		
2.7.3		Students and Values		
2.7.4		Scientific Temper		
	2.7.5	Plagiarism		
2.8	Let Us Sum Up	10 min.		
2.9	Terminal Questions	10 min.		
2.10	Solutions, Hints, Answers, References and Further Readings	25 min.		



Units	Title	Duration		
3	Features of Curriculum for School Science Education			
	3.1	Introduction <i>Learning Outcomes</i>	15 min.	
	3.2	Definition of Curriculum	30 min.	
		3.2.1		Need for Curriculum
		3.2.2		Process for Curriculum Development
		3.2.3		Models of Curriculum Development
	3.2.4	Types of Curriculum		
	3.3	Concept of Science Education	20 min.	
	3.4	Approach of Curriculum in Science Education	20 min.	
	3.5	Aims of Curriculum in Science Education	30 min.	
	3.6	Objectives of Curriculum in Science Education	30 min.	
	3.7	Validity for Curriculum in Science Education	30 min.	
	3.8	Principles of Curriculum in Science Education	30 min.	
	3.9	Curriculum for Science Education in India	30 min.	
3.10	Features of Curriculum for Science Education in School	20 min.		
3.11	Let Us Sum Up	10 min.		
3.12	Terminal Questions	10 min.		
3.13	Solutions, Hints, Answers, References and Further Readings	25 min.		

Units	Title	Duration	
4	Paradigms of Science Education		
	4.1	Introduction <i>Learning Outcomes</i>	15 min.
	4.2	Aims of Learning Science	30 min.
	4.3	Terms Associated with Teaching	30 min.
	4.4	Teaching Styles	30 min.
	4.5	Learning Styles	30 min.
	4.6	Learning Theories	30 min.
	4.7	Conventional Methods of Teaching Science	30 min.
	4.8	Constructivist Pedagogy	30 min.
	4.9	Constructivist Models of Teaching Science	30 min.
	4.10	Let Us Sum Up	10 min.
	4.11	Terminal Questions	10 min.
	4.12	Solutions, Hints, Answers, References and Further Readings	25 min.

Units	Title	Duration		
5	Pedagogy of Science Teaching-learning			
	5.1	Introduction <i>Learning Outcomes</i>	15 min.	
	5.2	Role of Observation, Inference and Inquiry in Learning Science	120 min.	
		5.2.1		Observation: Natural & Staged; Quantitative and Qualitative
		5.2.2		Observation and Inference
	5.2.3	Inquiry as Process of Learning Science		
5.3	Physical Science	60 min.		



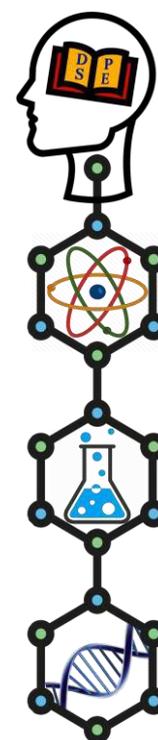
5.4	Biological Science	60 min.
5.5	Let Us Sum Up	10 min.
5.6	Terminal Questions	10 min.
5.7	Solutions, Hints, Answers, References and Further Readings	25 min.

Units	Title	Duration	
06	Basic Skills for Science Teaching		
	6.1	Introduction <i>Learning Outcomes</i>	45 min.
	6.1.1	Basic Science Teaching Skills	
	6.1.2	Integrated Science Teaching Skills	
	6.1.3	Need for Integrating the Teaching Skills	
	6.2	Skill of Introducing the Lesson	15 min.
	6.3	Skills of Explaining	15 min.
	6.4	Skill of Illustrating with Examples	15 min.
	6.5	Skills of Probing Questions	15 min.
	6.6	Skill of Stimulus Variation	15 min.
	6.7	Skills of Reinforcement	15 min.
	6.8	Skills of Using Black Board	15 min.
	6.9	Skill of Handling ICT Tools	15 min.
	6.10	Skills of Closing Lesson	15 min.
	6.11	Skills of Classroom Management	15 min.
6.12	Reflection in Teaching Practices	45 min.	
	6.12.1		Reflection before the Lesson (Planning)
	6.12.2		Reflection During the Process (Execution)
	6.12.3		Reflection After the Process (Analysis)
6.13	Let Us Sum Up	10 min.	
6.14	Terminal Questions	10 min.	
6.15	Solutions, Hints, Answers, References and Further Readings	25 min.	

MODULE - II

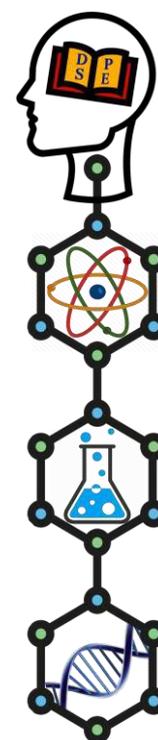
Module – II : Basics of Science Education –II		Credit
Unit-7	Planning in Learning Science	2
Unit-8	Use of ICTs in Learning Science	
Unit-9	Activity Based Learning (ABL)	
Unit-10	Science Beyond Textbooks	
Unit-11	Science Process Skills and Learning Outcomes	
Unit-12	Understanding Environment	

Module – II : Basics of Science Education –II			
Units	Title	Duration	
7	Planning in Learning Science		
	7.1	Introduction <i>Learning Outcomes</i>	15 min.
	7.2	Planning a Lesson and Learning	50 min.
7.2.1		Preparation	



7.3	Why Planning is Important in Learning Science?	25 min.
7.4	Planning and Learning Science	50 min.
	7.4.1 Science at Elementary Stage	
	7.4.2 Science at Secondary Stage	
7.5	A Planning Model (Using Learning Cycle)	25 min.
7.6	Planning for Science Education to Design Learning	90 min.
	7.6.1 Hands on Learning	
	7.6.2 Story Telling	
	7.6.3 Role Play	
	7.6.4 Visual Clues	
	7.6.5 Instructional Conversations	
	7.6.6 Word Games	
	7.6.7 Word Parts	
	7.6.8 Virtual Science Laboratory	
	7.6.9 Context-Based Learning	
	7.6.10 Science Museums	
	7.6.11 Projects	
	7.6.12 Multimedia Approach	
	7.6.13 ICT Enabled Learning	
	7.6.14 Science Fair	
7.7	Let Us Sum Up	10 min.
7.8	Terminal Questions	10 min.
7.9	Solutions, Hints, Answers, References and Further Readings	25 min.

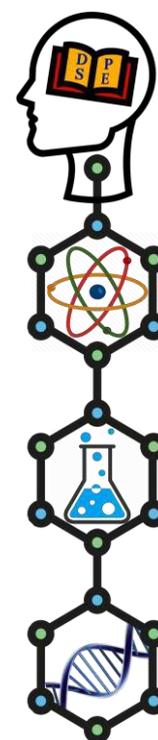
Units	Title	Duration	
8	Use of ICTs in Learning Science		
	8.1	Introduction <i>Learning Outcomes</i>	15 min.
	8.2	What is ICT?	10 min.
	8.3	Why ICT?	10 min.
	8.4	ICT Resources in Science Education	75 min.
		8.4.1 Audio	
		8.4.2 Video	
		8.4.3 Internet and Learning	
		8.4.4 OER & AO	
		8.4.5 Web Portal	
		8.4.6 Mobile and Software Application	
		8.4.7 Assistive Technology	
		8.4.8 Virtual Lab	
	8.5	ICT Interventions at the State and National Level	35 min.
	8.6	Managing a Virtual Classroom	75 min.
		8.6.1 Video Conferencing Platform	
		8.6.2 Online Interactive Boards	
8.6.3 Online tools/ Software for Integration			
8.7	Limitation of ICT	35 min.	



	8.8	Let Us Sum Up	10min.
	8.9	Terminal Questions	10min.
	8.10	Solutions, Hints, Answers, References and Further Readings	15min.

Units	Title		Duration	
9	Activity Based Learning (ABL)			
	9.1	Introduction <i>Learning Outcomes</i>	15 min.	
	9.2	Types of Activities		30 min.
		9.2.1	Activities Inside Classroom	
		9.2.2	Activities Outside Classroom	
	9.3	Planning and Organizing Activities		150 min.
		9.3.1	Identification of Materials and Resources	
		9.3.2	Engaging Learners in ABL	
		9.3.3	Hand-holding the Learners	
		9.3.4	Assessment of Learners During and After Activities	
	9.4	Use of Activities Towards Construction of Knowledge : Learner Participation	30 min.	
	9.5	Teacher as a Facilitator	30 min.	
9.6	Let Us Sum Up	10 min.		
9.7	Terminal Questions	10 min.		
9.8	Solutions, Hints, Answers, References and Further Readings	25 min.		

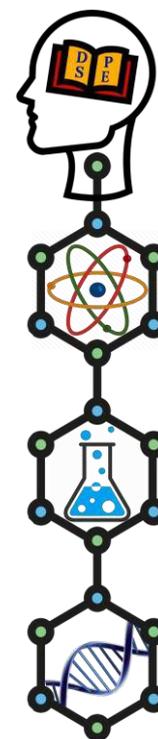
Units	Title		Duration	
10	Science Beyond Textbooks			
	10.1	Introduction <i>Learning Outcomes</i>	15 min.	
	10.2	Do You Observe Keenly the World Around You?	30 min.	
	10.3	Knowing Indian Scientists, Mathematicians Engineers, Astronomers	30 min.	
	10.4	Organizing Science Exhibitions in Schools	30 min.	
	10.5	Observing Days of Scientific Importance		60 min.
		10.5.1	National Science Day (28 th February)	
		10.5.2	National Engineers' Day (15 th September)	
		10.5.3	National Mathematics Day (22 nd December)	
		10.5.4	World Environment Day (5 th June)	
	10.6	Fun Facts, Limericks, Poems, Dramas, Films, Sciencetoons	30 min.	
	10.7	Popular Science Magazines, Science Club	60 min.	
	10.8	Let Us Sum Up	10 min.	
10.9	Terminal Questions	10 min.		
10.10	Solutions, Hints, Answers, References and Further Readings	15 min.		



Units	Title		Duration
11	Science Process Skill and Learning Outcome		
	11.1	Introduction <i>Learning Outcomes</i>	15 min.
	11.2	Overview of Process Skills in Science	
11.2.1.		Shift from Product to Process of Science	

	11.2.2	Arguments For and Against Process Approach of Science Teaching	
	11.2.3	Balance between Process and Product Approach in Science Education	
11.3	Science Process Skills		90 min.
	11.3.1	Six Basic Process Skills	
	11.3.2	Integrated Science Process Skills	
	11.3.3	Expected Process Skills at Secondary Stage	
11.4	Learning and Learning Outcomes		90 min.
	11.4.1	Learning	
	11.4.2	Learning Outcomes	
	11.4.3	How to Write Student's Learning Outcomes	
	11.4.4	Bloom's Taxonomy of Measurable Verbs	
	11.4.5	Format for Learning Outcome Statements	
	11.4.6	Relating Pedagogical Process Skills and Learning Outcomes	
11.5	Let Us Sum Up		10 min.
11.6	Terminal Questions		10 min.
11.7	Solutions, Hints, Answers, References and Further Readings		25 min.

Units	Title	Duration
12	Understanding Environment	
	12.1 Introduction <i>Learning Outcomes</i>	15 min.
	12.2 Nature, Ecology and Environment	30 min.
	12.2.1 Nature	
	12.2.2 Ecology	
	12.2.3 Environmental Science	
	12.2.4 Branches of Ecology	
	12.3 Important Terminology used in Environmental Studies	30 min.
	12.3.1 Ecosystem Service	
	12.4 What is Environmental Science?	45 min.
	12.4.1 Biological System	
	12.4.2 Ecosystems: From Micro to Macro	
	12.4.3 Structural and Functional Aspects of Ecosystem	
	12.4.4 Ecological Pyramids	
	12.5 Environmental Sustainability and Ecological Foot Print	30 min.
	12.5.1 Sustainable Development Concept	
	12.5.2 Principle of Sustainable Development	
	12.5.3 Ecological Foot Print	
	12.6 Effects of Different Types of Pollution (Air, Water, Soil, Noise and Light)	30 min.
	12.7 Multidisciplinary Approach Towards Understanding the Impact of Pollution	30 min.
	12.7.1 Indicator Species	
	12.7.2 Coral Bleaching	
	12.8 Major Environmental Concerns	45 min.

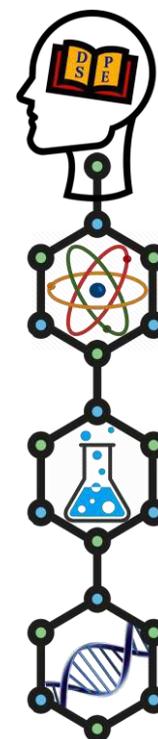


		12.8.1	Global Warming	
		12.8.2	Impact of Global Warming	
		12.8.3	Remedial Measures	
		12.8.4	Green Economy	
	12.9	Eco Technology		30 min.
		12.9.1	Use of Non- Conventional Energy Resources	
		12.9.2	Waste Management and Biodegradability	
		12.9.3	Recycle of the Wastes	
		12.9.4	Green Life Style	
	12.10	Let Us Sum Up		10 min.
	12.11	Terminal Questions		10 min.
	12.12	Solutions, Hints, Answers, References and Further Readings		25 min.

MODULE - III

Module – III : Teaching-learning of Physical Science-I			Credit
Unit-13	Prelude 1: Teaching-learning of Physical Science-I		2
Unit-14	Prelude 2: Teaching-learning of Physical Science - I		
Unit-15	Core Essentials-I : Physical Science		
Unit-16	Core Essentials -II : Physical Science		
Unit-17	Core Essentials -III : Physical Science		
Unit-18	Core Essentials -IV : Physical Science		

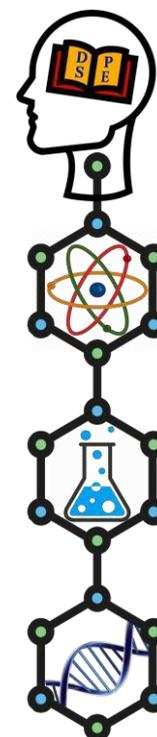
Module – III : Teaching-learning of Physical Science-I			Duration	
Units	Title		Duration	
13	Prelude 1 : Teaching-learning of Physical Science-I			
	13.1	Introduction <i>Learning Outcomes</i>	15 min.	
	13.2	The Physical World		60 min.
		13.2.1	Perceptibility by Sensory Organs	
		13.2.2	Imperceptibility of Our Sensory Organs	
	13.3	The Need for Assumptions		90 min.
	13.4	Analogies and Modeling		90 min.
		13.4.1	Analogies	
		13.4.2	Modeling	
		13.4.3	Hypothesization	
		13.4.4	Roles of Anecdotes, Limericks & Sciotoons	
	13.5	Let Us Sum Up		10 min.
	13.6	Terminal Questions		10 min.
	13.7	Solutions, Answers, Hints, References and Further Readings		25 min.



Units	Title		Duration	
14	Prelude 2: Teaching-learning of Physical Science - I			
	14.1	Introduction <i>Learning Outcomes</i>	15 min.	
	14.2	Quantification		90 min.
		14.2.1	Measurements	
		14.2.2	Unit and Dimensions	

	14.2.3	Significant Figures	
	14.2.4	The Role of Approximation	
14.3	Scientific Notations, Symbols and Signs		60 min.
	14.3.1	IUPAC and Its Role in Chemistry	
	14.3.2	Nomenclature	
14.4	Chemical Formula and Equations		45 min.
14.5	Scientific Convention		45 min.
14.6	Let Us Sum Up		10 min.
14.7	Terminal Questions		10 min.
14.8	Solutions, Hints, Answers, References and Further Readings		25 min.

Units	Title		Duration
15	Core Essentials-I : Physical Science		
	15.1	Introduction <i>Learning Outcomes</i>	15 min.
	15.2	Position and Time as Variables	60 min.
	15.2.1	Displacement vs. Time Graph	
	15.2.2	Velocity vs. Time Graph	
	15.2.3	Kinematic Equations of Motion	
	15.3	Qualitative and Quantitative Definitions of Force	60 min.
	15.3.1	Why Change of Momentum is Important?	
	15.4	Universality of Gravitation	60 min.
	15.4.1	The Apple and The Moon Fall Towards the Earth in the Same Manner	
	15.4.2	Weightlessness	
	15.5	Teaching Inputs Pertaining to Some Key Concepts	60 min.
	15.5.1	No-Work Forces	
	15.5.2	KE and PE Associated with SHM	
	15.6	Let Us Sum Up	10 min.
	15.7	Terminal Questions	10 min.
	15.8	Solution, Hints, Answers, References and Further Readings	25 min.

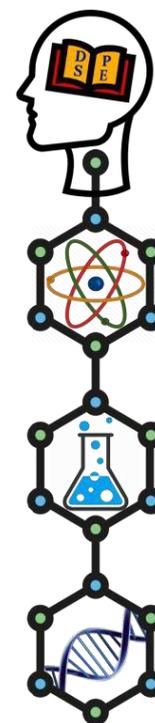


Units	Title		Duration
16	Core Essentials-II : Physical Science		
	16.1	Introduction <i>Learning Outcomes</i>	15 min.
	16.2	The Principle of Conservation of Energy	120 min.
	16.2.1	Gravitational Potential Energy	
	16.2.2	Work and Kinetic Energy	
	16.2.3	Total Mechanical Energy	
	16.2.4	Conversion of Energy from Potential to Kinetic	
	16.3	Sound: Energy Associated with Vibrational Motion	120 min.
	16.3.1	Simple Pendulum	
	16.3.2	Spring – Mass System	
	16.3.3	Variable Force and Vibrational Energy in SHM	
	16.3.4	Conservation of Vibrational Energy	
	16.3.5	Wave Motion: A Consequence of Vibration	
	16.3.6	Phase of a Wave	

	16.3.7	Sound as Longitudinal Wave	
	16.4	Let Us Sum Up	10 min.
	16.5	Terminal Questions	10 min.
	16.6	Solution, Hints, Answers, References and Further Readings	25 min.

Units	Title		Duration	
17	Core Essentials-III : Physical Science			
	17.1	Introduction <i>Learning Outcomes</i>	15 min.	
	17.2	Materials : Nature and Composition		60 min.
		17.2.1	Ultimate Particles and Their Types	
		17.2.2	Solids, Liquids and Gases	
	17.3	Effect of Temperature and Pressure on Inter-convertibility of States		90 min.
		17.3.1	Latent Heat of Vaporization and Latent Heat of Fusion	
		17.3.2	Bulk and Surface Phenomena	
	17.4	Mixture, Solution, Alloys & Compounds		90 min.
		17.4.1	Suspension and Colloids	
		17.4.2	Physical and Chemical Change	
17.5	Let Us Sum Up		10 min.	
17.6	Terminal Questions		10 min.	
17.7	Solutions, Hints, Answers, References and Further Readings		25 min.	

Units	Title		Duration	
18	Core Essentials-IV : Physical Science			
	18.1	Introduction <i>Learning Outcomes</i>	15 min.	
	18.2	Law of Definite Proportion & Chemical Formula		120 min.
		18.2.1	Valency: Grammar of Chemical Formula	
		18.2.2	Significance of Relative Atomic Mass and Carbon - 12 Isotopes	
		18.2.3	Interplay between Avogadro Constant, the Mole and Molar Mass	
	18.3	Exploring Atom		120 min.
		18.3.1	Introduction	
		18.3.2	Famous Experimental Observation Leading to Different Atomic Models	
		18.3.3	Sub-Atomic Particles: Discovery and Nature	
		18.3.4	K.L.M.N., Shells and their Electron Accommodation Capacity	
18.4	Let Us Sum Up		10 min.	
18.5	Terminal Questions		10 min.	
18.6	Solutions, Hints, Answers and References.		25 min.	



MODULE - IV

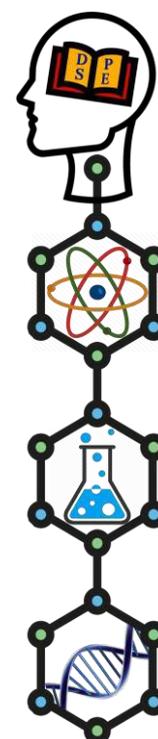
Module – IV : Teaching-learning of Biological Science - I		Credit
Unit-19	Prelude 1:Teaching-learning of Biological Science-I	2
Unit-20	Prelude 2:Teaching-learning of Biological Science-I	
Unit-21	Core Essentials-I : Biological Science	
Unit-22	Core Essentials -II : Biological Science	
Unit-23	Core Essentials -III : Biological Science	
Unit-24	Core Essentials -IV : Biological Science	

Module – IV : Teaching-learning of Biological Science-I

Units	Title	Duration		
19	Prelude 1: Teaching-learning of Biological Science-I			
	19.1	Introduction <i>Learning Outcomes</i>	15 min.	
	19.2	The Wonder of Biological World	60 min.	
		19.2.1		Diversity of Plants and Animals World
		19.2.2		Similarities of Bio-Dome
		19.2.3		Architecture of Plants and Animals
		19.2.4		Organisms Visible to Eye
	19.3	Coexistence of Plants and Animals	90 min.	
		19.3.1		Evolution of Ecosystem
	19.4	Processes of Biosystem	90 min.	
	19.5	Let Us Sum Up	10 min.	
	19.6	Terminal Questions	10 min.	
	19.7	Solutions, Hints, Answers, References and Further Readings	25 min.	

Units	Title	Duration		
20	Prelude 2: Teaching-learning of Biological Science-I			
	20.1	Introduction <i>Learning outcomes</i>	15 min.	
	20.2	Quantification	90 min.	
		20.2.1		Measurements and Units
		20.2.2		Significant Phenomena
	20.2.3	Importance of Mimicking Natural Objects		
	20.3	Scientific Notations	60 min.	
	20.4	Conversion, Pathway, Cycles and Equations	45 min.	
	20.5	Scientific Conventions, Treaties	45 min.	
20.6	Let Us Sum Up	10 min.		
20.7	Terminal Questions	10 min.		
20.8	Solutions, Hints, Answer, References and Further Readings	25 min.		

Units	Title	Duration	
21	Core Essentials-I : Biological Science		
	21.1	Introduction <i>Learning Outcomes</i>	15 min.
	21.2	Brief Summary of Cell Organelles of Plants and Animals: Structure and Function	60 min.

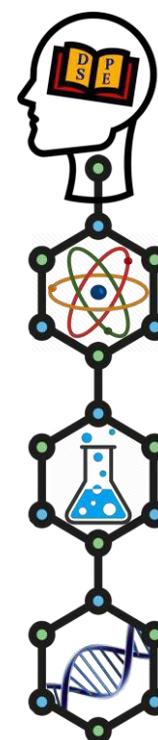


	21.2.1	Cell Division: Need, Types and Processes	30 min.
21.3	Plant and Animal Tissue: Variation in Shape and Function		60 min.
	21.3.1	Elements to form Tissue	30 min.
	21.3.2	Mechanics of Muscle Fibre	30 min.
21.4	Characteristics of Various Plant and Animal Tissue and Organ Systems		30 min.
21.5	Let Us Sum Up		10 min.
21.6	Terminal Questions		10 min.
21.7	Solutions, Hints, Answers, References and Further Readings		25 min.

Units	Title	Duration	
22	Core Essentials-II : Biological Science		
22.1	Introduction <i>Learning Outcomes</i>	15 min.	
22.2	Classification: The Process of Grouping Organisms	75 min.	
22.3	Classification, Evolution and Characteristics: Interrelationship	75 min.	
	22.3.1	Binomial Nomenclature and Its Procedure	60 min.
22.4	Classification of Plant World and Animal World	30 min.	
	22.4.1		Classification of Plant World
	22.4.2		Classification of Animal World
22.5	Let Us Sum Up	10 min.	
22.6	Terminal Questions	10 min.	
22.7	Solutions, Hints, Answers, References and Further Readings	25 min.	

Units	Title	Duration	
23	Core Essentials-III : Biological Science		
23.1	Introduction <i>Learning Outcomes</i>	15 min.	
23.2	Health, Economy and Education	90 min.	
	23.2.1		Health and Education
	23.2.2		Health and Economy
23.3	Concept of Disease	120 min.	
	23.3.1		Classification of Diseases
	23.3.2		Infectious Diseases
	23.3.3		What are Infectious Agents?
	23.3.4		Types of Infectious Diseases
	23.3.5		Non-infectious Diseases
23.4	Preventive Measures for diseases	30 min.	
23.5	Let Us Sum Up	10 min.	
23.6	Terminal Questions	10 min.	
23.7	Solutions, Hints, Answers and References.	25 min.	

Units	Title	Duration
24	Core Essentials-IV : Biological Science	
24.1	Introduction <i>Learning Outcomes</i>	15 min.
24.2	Air, Water, Soil and Sun: Essentials to Sustain Life on Earth	90 min.
	24.2.1	



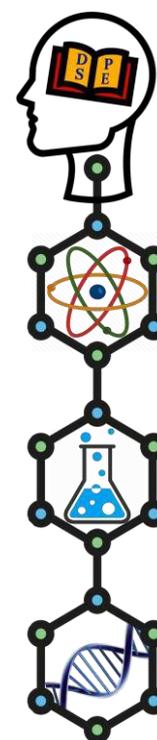
	24.2.2	Meaning of Pollution and its Effect on Biodiversity	
24.3	Nutrients: Essential for Crops		90 min.
	24.3.1	Organic and Inorganic Farming	
	24.3.2	Storage of Grains: Significance	
24.4	Management of Animal Life Stocks		30 min.
	24.4.1	Brief Review of Selected Animal Farmings	30 min.
24.5	Let Us Sum Up		10 min.
24.6	Terminal Questions		10 min.
24.7	Solutions, Hints, Answers, References and Further Readings		25 min.

MODULE – V

Module – V : PRACTICAL MANUAL	Credit
PRACTICAL MANUAL	4+4=8

MODULE - VI

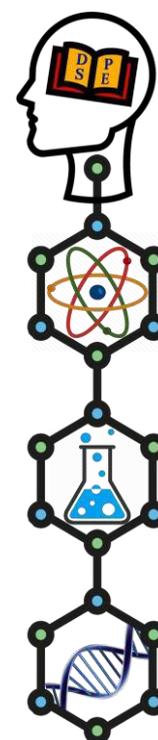
Module – VI : Teaching-learning of Physical Science-II		Credit
Unit-25	Core Essentials – V : Physical Science	2
Unit-26	Core Essentials – VI : Physical Science	
Unit-27	Core Essentials – VII : Physical Science	
Unit-28	Core Essentials – VIII : Physical Science	
Unit-29	Dealing with Real Life Situations-I	
Unit-30	Dealing with Real Life Situations - II	



Units	Title	Duration		
25	Core Essentials – V : Physical Science			
	25.1	Introduction <i>Learning Outcomes</i>	15 min.	
	25.2	Spherical Mirror and Image Formed by a Spherical Mirror		30 min.
		25.2.1	Image Formation by a Concave Mirror	
		25.2.2	Image Formation by a Convex Mirror	
	25.3	Refraction of Light		30 min.
		25.3.1	Refraction of Light Through a Rectangular Glass Plate	
		25.3.2	Refraction of Light Through a Prism	
		25.3.3	Refractive Index	
	25.4	Image Formed by a Spherical Lens		30 min.
		25.4.1	Image formation by a Convex Lens	
25.4.2		Image Formation By a Concave Lens		
25.5	Sign Convention for Spherical Mirrors and Lenses		30 min.	

25.6	Mirror Formula and Lens Formula	30 min.
25.7	Magnification: Spherical Mirrors and Lenses	30 min.
25.8	Tracing Ray Diagrams for Image Formation Using Graph Paper	30 min.
25.9	Power of a Lens and Additive Law	30 min.
25.10	Why Do We Need Spectacles?	10 min.
25.11	Let Us Sum Up	25 min.
25.12	Terminal Questions	10 min.
25.13	Solutions, Hints, Answers, References and Further Readings	10 min.

Units	Title	Duration		
26	Core Essentials – VI : Physical Science			
	26.1	Introduction <i>Learning Outcomes</i>	15 min.	
	26.2	Revisiting Coulomb's Law and Universal Law of Gravitation as Inverse Square Law	30 min.	
	26.3	Conservation and Quantization of Charge	30 min.	
	26.4	Charges in Motion	30 min.	
		26.4.1		Flow of Electric Charges Through Solids
		26.4.2		Flow of Electric Charges Through Solutions
	26.5	Electric Potential	30 min.	
		26.5.1		Potential Difference
		26.5.2		emf
	26.6	Ohm's Law and $I \sim V$ Graph	120 min.	
		26.6.1		Limitations of Ohm's Law
		26.6.2		Resistivity
		26.6.3		Electric Energy and Power
26.6.4		Electric Bill and Calculation of Electric Energy Bill		
26.6.5		Process of Electroplating using Electrodes		
26.6.6		Comparison Between Electric Field and Magnetic Field		
26.6.7		Interaction Between Current Carrying Conductors		
26.6.8	Interaction Between Magnets			
26.7	Let Us Sum Up	25 min.		
26.8	Terminal Questions	10 min.		
26.9	Solutions, Hints, Answers, References and Further Readings	10 min.		
Units	Title	Duration		
27	Core Essentials – VII : Physical Science			
	27.1	Introduction <i>Learning Outcomes</i>	15 min.	
	27.2	Symbolic Representation of Chemical Reaction	60 min.	
		27.2.1		Representation of Various Chemical Reactions and Their Interpretation
		27.2.2		Need of Writing Equation in Balanced Form and Its Method
27.3	Types of Substances (Acid, Base, Salt)	90 min.		

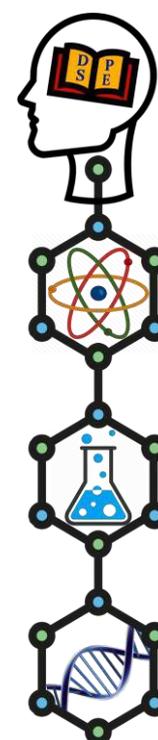


	27.3.1	Distinct Attributes of Acid, Base and Salt	
	27.3.2	Chemical and Physical Behavior of Acid, Base and Salt	
	27.3.3	Classification of Elements as Metals and Non-Metals	
	27.4	Oxidation and Reduction	90 min.
	27.4.1	Oxidation and Reduction: Always Together	
	27.4.2	Reduction: Loss of Oxygen or Gain of Hydrogen	
	27.5	Let Us Sum Up	10 min.
	27.6	Terminal Questions	10 min.
	27.7	Solutions, Hints, Answers, References and Further Readings	25 min.

Units	Title	Duration
28	Core Essentials – VIII : Physical Science	
	28.1 Introduction <i>Learning Outcomes</i>	15 min.
	28.2 Carbon : A Vital Element of Life	120 min.
	28.2.1 Representation of Organic Compounds	
	28.2.2 Various Chemical Reactions Exhibited by Carbon Compound	
	28.3 Easier Method of Studying Elements	120 min.
	28.3.1 Classification and Grouping of Elements	
	28.4 Let Us Sum Up	10 min.
	28.5 Terminal Questions	10 min.
	28.6 Solutions, Hints, Answers, References and Further Readings	25 min.

Units	Title	Duration
29	Dealing with Real Life Situations-I	
	29.1 Introduction <i>Learning Outcomes</i>	15 min.
	29.2 Applications of Newton's Laws (of Motion)	120 min.
	29.2.1 Use of Newton's Second Law	
	29.2.2 Use of Newton's Third Law	
	29.2.3 Application of Archimedes Principle	
	29.3 Tabulation of Consumed Electricity	30 min.
	29.4 Use of Speed of Sound	90 min.
	29.4.1 Echo, Reverberation and Resonance	
	29.4.2 Use of Ultrasonics: Medical and Engineering Fields	
	29.4.3 Application of Magnetic Effect of Current	
	29.5 Let Us Sum Up	10 min.
	29.6 Terminal Questions	10 min.
	29.7 Solutions, Hints, Answers, References and Further Readings	25 min.

Units	Title	Duration
30	Dealing with Real Life Situations - II	
	30.1 Introduction <i>Learning Outcomes</i>	15 min.
	30.2 Water Purification in Water Works	30 min.

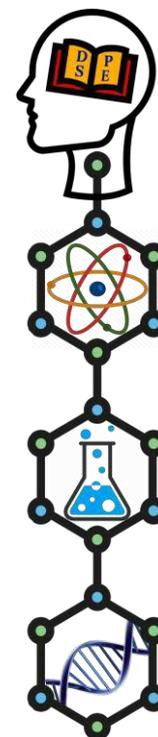


	30.3	Uses of Isotopes	100 min.
	30.3.1	Isotopes of Uranium as Nuclear Fuel	
	30.3.2	Isotopes of Cobalt	
	30.3.3	Isotopes of Iodine	
	30.4	Purification of Salts	20 min.
	30.4.1	Separation of Crystals	90 min
	30.4.2	Separation of Gases	
	30.4.3	Separation of Two Immiscible Liquids	
	30.4.4	Separation of Two Miscible Liquids	
	30.5	Let Us Sum Up	10 min.
30.6	Terminal Questions	10 min.	
30.7	Solutions, Hints, Answers, References and Further Readings	25 min.	

MODULE - VII

Module – VII : Teaching-learning of Biological Science-II		Credit
Unit-31	Core Essentials – V : Biological Science	2
Unit-32	Core Essentials – VI : Biological Science	
Unit-33	Core Essentials – VII : Biological Science	
Unit-34	Core Essentials – VIII : Biological Science	
Unit-35	Dealing with Real Life Situations-I	
Unit-36	Dealing with Real Life Situations - II	

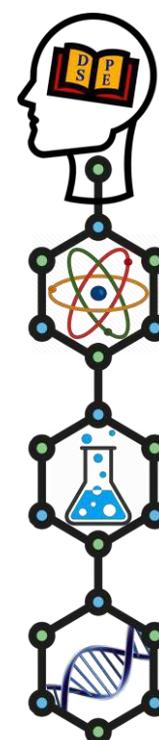
Units	Title	Duration		
31	Core Essentials – V : Biological Science			
	31.1	Introduction <i>Learning Outcomes</i>	15 min.	
	31.2	How Plants and Animal Activities/Responses Are Controlled and Coordinated?	30 min.	
	31.3	Responses of Plants (Types of Tropisms)	45 min.	
		31.3.1		Phototropisms
		31.3.2		Gravitropisms
	31.4	Plant Hormones	45 min.	
		31.4.1		Auxins
		31.4.2		Gibberellic Acid
		31.4.3		Cytokinin and Ethylene
	31.4.4	Absciscic Acid (ABA)		
	31.5	Animal Hormones	30 min.	
	31.6	Parts of Brain and Their Functions	60 min.	
		31.6.1		Reflex Arc
31.7	Autonomic Nervous System	30 min.		
31.8	Let Us Sum Up	10 min.		
31.9	Terminal Questions	10 min.		
31.10	Solutions, Hints, References and Further Readings	25 min.		



Units	Title	Duration	
32	Core Essentials – VI : Biological Science		
	32.1	Introduction <i>Learning Outcomes</i>	15 min.
	32.2	Chlorophyll, Chloroplast and Sites of Photosynthesis	60 min.
	32.3	Mechanism of Photosynthesis	60 min.
	32.4	Factors Affecting Photosynthesis	30 min.
	32.5	Glands: Their Contribution to Digestion	60 min.
	32.6	Schematization of Entire Human Digestive System	30 min.
	32.7	Let Us Sum Up	10 min.
	32.8	Terminal Questions	10 min.
	32.9	Solutions, Hints, Answers, References and Further Readings	25 min.

Units	Title	Duration		
33	Core Essentials – VII : Biological Science			
	33.1	Introduction <i>Learning Outcomes</i>	15 min.	
	33.2	Respiration in Plants and Animals	60 min.	
		33.2.1		Respiration in Plants
		33.2.2		Respiration in Animals
	33.3	Mechanism of Breathing in Human	60 min.	
		33.3.1		Respiratory System of Human
		33.3.2		Course of Circulation of Blood
		33.3.3		Exchange of Gases
		33.3.4		Process of Breathing
	33.4	Exchange of Gases between Tissue and Blood	30 min.	
	33.5	Blood – The Exotic Fluid	90 min.	
		33.5.1		Plasma
		33.5.2		Formed Elements
33.6	Let Us Sum Up	10 min.		
33.7	Terminal Questions	10 min.		
33.8	Solutions, Hints, Answers, References and Further Readings	25 min.		

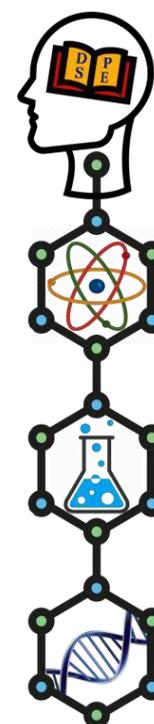
Units	Title	Duration		
34	Core Essentials – VIII : Biological Science			
	34.1	Introduction <i>Learning Outcomes</i>	15 min.	
	34.2	Variations: Created and Inherited	30 min.	
		34.2.1	DNA and RNA	30 min.
		34.2.2	Analysis of Mendel's Experiments	30 min.
		34.2.3	The Gene	30 min.
		34.2.4	How Traits are Inherited?	30 min.
	34.3	Biological Evolution		
		34.3.1	Frequency of Inherited Trait	15 min.
		34.3.2	Natural Selection: A Survival Advantage	15 min.
		34.3.3	Adaption and Accidental Survival	30 min.
		34.3.4	Genetic Drift: No Assured Guarantee	30 min.



	34.5	Let Us Sum Up	10 min.
	34.6	Terminal Questions	10 min.
	34.7	Solutions, Hints, Answers, References and Further Readings	25 min.

Units	Title		Duration	
35	Dealing with Real Life Situations-I			
	35.1	Introduction <i>Learning Outcomes</i>	15 min.	
	35.2	Pumping of Blood: Sphygmomanometer (SM)		60 min.
		35.2.1	Heart as a Pump	
		35.2.2	Concept of Pressure	
	35.3	Hemodialysis		30 min.
		35.3.1	Compare Dialysis with Function of Kidney	
	35.4	Insulin as a Hormone		60 min.
		35.4.1	Diabetes	
		35.4.2	Need of Hormones	
	35.5	Tissue Culture: Boon of Biotechnology		30 min.
	35.6	Reproductive Health		60 min.
		35.6.1	Wanted and Unwanted Pregnancy etc.	
	35.7	Let Us Sum Up		10 min.
35.8	Terminal Questions		10 min.	
35.9	Solutions, Hints, Answers, References and Further Readings		25 min.	

Units	Title		Duration	
36	Dealing with Real Life Situations-II			
	36.1	Introduction <i>Learning Outcomes</i>	15 min.	
	36.2	Genuineness of DNA		90 min.
		36.2.1	Use of DNA Fingerprints	
		36.2.2	DNA Test	
		36.2.3	DNA and Biotechnology	
	36.3	Origin of Life		30 min.
	36.4	Evolutionary Relationship		60 min.
		36.4.1	Homologous Organs	
		36.4.2	Analogous Organs	
		36.4.3	Molecular Phylogeny	
		36.4.4	Artificial Creation of Complex Organs	
	36.5	Understanding Fossils		60 min.
		36.5.1	Fossils Reveal Age	
		36.5.2	Carbon Dating	
		36.5.3	Origin of Homosapien	
36.6	Let Us Sum Up		10 min.	
36.7	Terminal Questions		10 min.	
36.8	Solutions, Hints, Answers, References and Further Readings		25 min.	

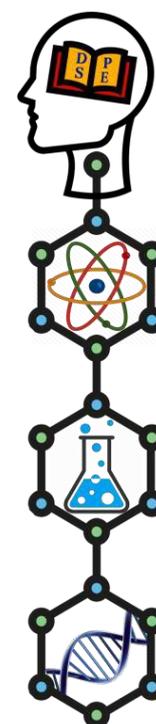


MODULE - VIII

Module –VIII : Assessments and Evaluations		Credit
Unit-37	Assessments and Evaluations in Learning Science	2
Unit-38	Dimensions and Levels of Learning	
Unit-39	Assessment and Evaluation Tools - I	
Unit-40	Assessment and Evaluation Tools - II	
Unit-41	Statistical Analysis of Evaluation Data	

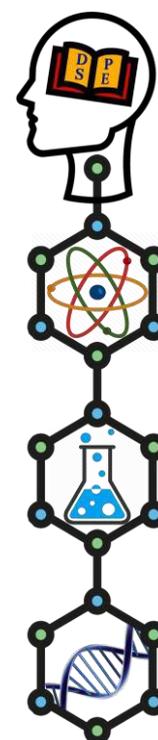
Module – VIII : Assessments and Evaluations			Duration	
Units	Title		Duration	
37	Assessments and Evaluations in Learning Science			
	37.1	Introduction <i>Learning Outcomes</i>	15 min.	
	37.2	Perspectives of Assessment and Evaluation		75 min.
		37.2.1	Difference Between Assessment and Evaluation	
		37.2.2	Assessment in Constructivist Perspectives	
		37.2.3	Assessment of Learning	
	37.3	Continuous Comprehensive Evaluation (CCE)		120 min.
		37.3.1	Evaluation of Theoretical Knowledge	
		37.3.2	Evaluation of Practical Component	
		37.3.3	Evaluation of Project Work	
	37.4	Current Practices in Assessment and Evaluation		45 min.
	37.5	Let Us Sum Up		10 min.
	37.6	Terminal Questions		10 min.
37.7	Solutions, Hints, Answers, References and Further Readings		15 min.	

Units	Title		Duration	
38	Dimensions and Levels of Learning			
	38.1	Introduction <i>Learning Outcomes</i>	15 min.	
	38.2	Dimensions of Learning		150 min.
		38.2.1	Dimensions of Learning: Basic Assumptions	
		38.2.2	The Five Dimensions of Learning	
		38.2.3	Relationship Among the Dimensions of Learning	
	38.3	Levels of Learning in Science Education		45 min.
		38.3.1	Bloom's Taxonomy	
		38.3.2	Bloom's Revised Taxonomy	
	38.4	Assessment of Learning using Revised Bloom's Taxonomy		45 min.
	38.5	Let Us Sum Up		10 min.
38.6	Terminal Questions		10 min.	
38.7	Solutions, Hints, Answers, References and Further Readings		25 min.	



Units	Title	Duration	
39	Assessment and Evaluation Tools - I		
	39.1	Introduction <i>Learning Outcomes</i>	15 min.
	39.2	Task Based Assessment	60 min.
	39.2.1	What are the Types of Performance Based Assessment?	
	39.2.2	How can we Assess?	
	39.2.3	How to Design and Assess a Performance Task?	
	39.3	Assignment (Home Assignment)	60 min.
	39.3.1	What to Consider When Using Assignments as an Assessment Method for a Course?	
	39.3.2	When Assessing with Assignments, What We Should Pay Attention to?	
	39.4	Practical (Laboratory work)	30 min.
	39.4.1	Why Practicals are Important Assessment Tool?	
	39.5	Projects (Model Making, Exhibits, ICT-Based Workshop, Collection of Samples, Materials etc.)	30 min.
	39.6	Demonstration (Stress on Development and Presentation)	30 min.
	39.7	Categorization of Assessment Indicators	30 min.
39.7.1	Assessment Indicator in Science		
39.8	Let Us Sum Up	10 min.	
39.9	Terminal Questions	10 min.	
39.10	Solutions, Hints, Answers, References and Further Readings	25 min.	

Units	Title	Duration	
40	Assessment and Evaluation Tools - II		
	40.1	Introduction <i>Learning Outcomes</i>	15 min.
	40.2	Achievement Test	60 min.
	40.2.1	Planning	
	40.2.2	Construction of Test Items	
	40.2.3	Evaluation of the Prepared Test	
	40.3	Screening Test	45 min.
	40.4	Survey Test	45 min.
	40.4.1	Meaning and Purpose	
	40.4.2	Types	
	40.4.3	Sample	
	40.4.4	Analysis	
	40.5	Diagnostic Test	45 min.
	40.5.1	Meaning and Nature	
	40.5.2	Construction of Diagnostic Test	
40.6	Checking of Answer Scripts	45 min.	
40.6.1	Subjective Measure (Marking Scheme)		
40.6.2	Objective Measure		
40.7	Let Us Sum Up	10 min.	
40.8	Terminal Questions	10 min.	
40.9	Solutions, Hints, Answers, References and Further Readings	25 min.	

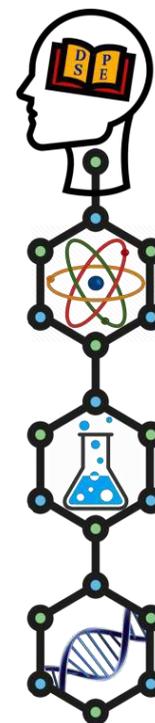


Units	Title	Duration
41	Statistical Analysis of Evaluation Data	
41.1	Introduction <i>Learning Outcomes</i>	15 min.
41.2	Generation of Data Through Evaluation	45 min.
41.2.1	Need for Statistical Analysis of Evaluation Data	
41.3	Data Representation	75 min.
41.3.1	Graphical Representation of Data	
41.4	Statistical Tools	120 min.
41.5	Let Us Sum Up	10 min.
41.6	Terminal Questions	10 min.
41.7	Solutions, Hints, Answers, References and Further Readings	40 min.

MODULE - IX

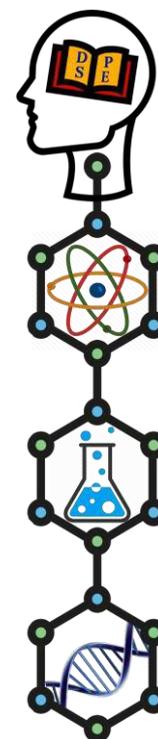
Module –IX : Science Education Research		Credit
Unit-42	Needs for Science Education Research (SER)	2
Unit-43	Evolution of Science Education Research	
Unit-44	Areas in Science Education Research (SER)	
Unit-45	Conducting Research in Science Education	
Unit-46	Quantitative and Qualitative Research in Science Education	

Units	Title	Duration
42	Needs for Science Education Research (SER)	
42.1	Introduction <i>Learning Outcomes</i>	15 min.
42.2	Why Research in Science Education?	30 min.
42.3	Teacher as a Researcher	90 min.
42.3.1	Researching During Classroom Teaching	
42.3.2	Researching Beyond Classroom Teaching	
42.4	Identifying the Need Base for Science Education Research (SER)	90 min.
42.4.1	Curricular Reform	
42.4.2	Syllabus Reform and Updating	
42.4.3	Reforms in Assessment Strategies	
42.4.4	Redesigning of Text-books	
42.4.5	Revisiting Pedagogy	
42.4.6	Feedback for Professional Development	
42.4.7	Inputs for Policy Framers	
42.5	How Learners Benefit from SER?	30 min.
42.6	Let Us Sum Up	10 min.
42.7	Terminal Questions	10 min.
42.8	Solutions, Hints, Answers, References and Further Readings	25 min.



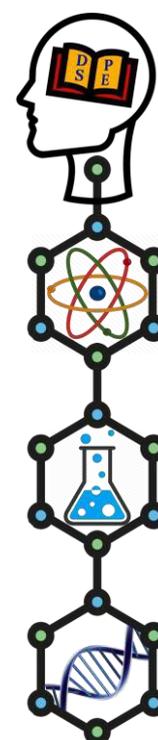
Units	Title	Duration		
43	Evolution of Science Education Research			
	43.1	Introduction <i>Learning Outcomes</i>	15 min.	
	43.2	Epistemics and Epistemology of SER	30 min.	
		43.2.1		Epistemology of SER
		43.2.2		Epistemic of SER
	43.3	Perspectives of SER & Issues Related to SER	90 min.	
		43.3.1		Perspectives of SER
		43.3.2		Recent Research Trends in Science Education
	43.4	Aspects Related to Science Education Research	60 min.	
		43.4.1		Historical Cultural and Socio-Cultural Issues of SER
		43.4.2		Cognitive Aspects/Issues of SER
		43.4.3		Curriculum and Pedagogical Issues of SER
		43.4.4		Affective Issues of SER
	43.5	Science Educational Research Spreads its Wings	60 min.	
		43.5.1		Through Journal
43.5.2		Magazines		
43.5.3		Newspapers		
43.5.4		Emergence of Academic Bodies		
43.5.5		Organisation of Seminars and Conferences		
43.6	Let Us Sum Up	10 min.		
43.7	Terminal Questions	10 min.		
43.8	Solutions, Hints, Answers, References and Further Readings	25 min.		

Units	Title	Duration		
44	Areas in Science Education Research (SER)			
	44.1	Introduction <i>Learning Outcomes</i>	15 min.	
	44.2	Identifying Areas of Research in Science Education	150 min.	
		44.2.1		Understanding Areas of Research in Science Education
		44.2.2		Science Learning: Conception and Conceptual Change
		44.2.3		Learning Environment
		44.2.4		Policy, Curriculum, Syllabus, Text Book and Learning Outcomes
		44.2.5		Pedagogy in Science Education
		44.2.6		Teacher Education / Development
	44.3	Research in Science Education: Concerning Inclusive Education	90 min.	
		44.3.1		Students Diversity and Science Education
		44.3.2		Tribal and Other Backward Communities
44.3.3		Learner with Special Needs and Talents		



	44.3.4	Gender issues in Science Education	
	44.3.5	Science Education in Rural, Urban Settings and Remote Habitations	
	44.4	Let Us Sum Up	10 min.
	44.5	Terminal Questions	10 min.
	44.6	Solutions, Hints, Answers, References and Further Readings	25 min.

Units	Title	Duration	
45	Conducting Research in Science Education		
	45.1 Introduction <i>Learning Outcomes</i>	15 min.	
	45.2 How to Go About with SER?	45.2.1 Selecting and Defining a Research Topic	75 min.
		45.2.2 Review of Related Literature	
		45.2.3 Developing Working Hypotheses	
		45.2.4 Preparing and Evaluating a Research Plan	
		45.2.5 Selecting Sample	
		45.2.6 Selecting Measuring Tools	
		45.2.7 Planning Analyzing Data	
	45.3 Guidelines for Writing a Research Proposal (NCERT's ERIC Format can be Adopted)	45.3.1 Title of the Study	90 min.
		45.3.2 Objectives and Research Questions are to	
		45.3.3 Intended Outcomes and Benefit	
		45.3.4 Method	
		45.3.5 Time Schedule and Budget	
		45.3.6 Organizational Frame Work	
		45.3.7 Persons Involved	
	45.4 Conducting Research on the Proposed Research Proposal	45.4.1 Critically Observing Learners	75 min.
		45.4.2 Administering Tools	
		45.4.3 Conducting Pre-Post Test	
		45.4.4 Studies with or without Control	
45.4.5 Reporting Research			
45.5 Let Us Sum Up	10 min.		
45.6 Terminal Questions.	10 min.		
45.7 Solutions, Hints, Answers, References and Further Readings	25 min.		



Units	Title	Duration	
46	Quantitative and Qualitative Research in Science Education		
	46.1 Introduction <i>Learning Outcomes</i>	15 min.	
	46.2 Types of Educational Research	46.2.1 Quantitative Research	240 min.
		46.2.2 Qualitative Research	
46.2.3 Mixed Methods Research			

	46.2.4	Comparison of the Three Types of Research	
	46.3	Let Us Sum Up	10 min.
	46.4	Terminal Questions	10 min.
	46.5	Solutions, Hints, Answers, References and Further Readings	25 min.

MODULE – X

Module – X : PROJECT GUIDE	Credit
<h1>PROJECT GUIDE</h1>	4

