

**TRAINING ON PRACTICAL SKILLS IN SCIENCE
USING SCIENCE KIT FOR SECONDARY SCHOOL
SCIENCE TEACHER**

PROGRAMME REPORT

DEE/2017-18/PAC 16.43



DR. R.P. PRAJAPATI

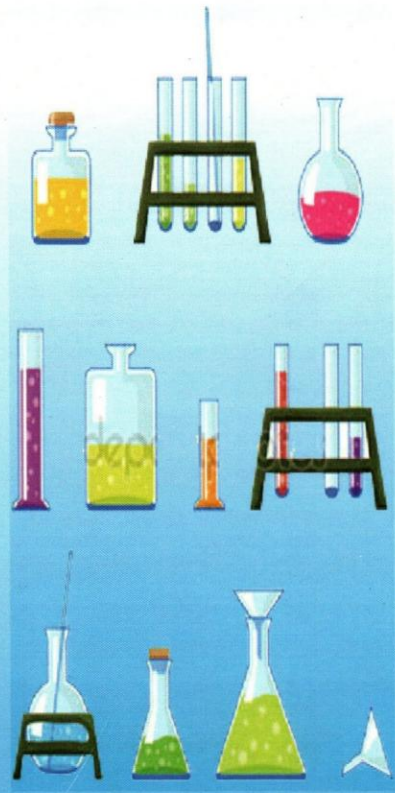
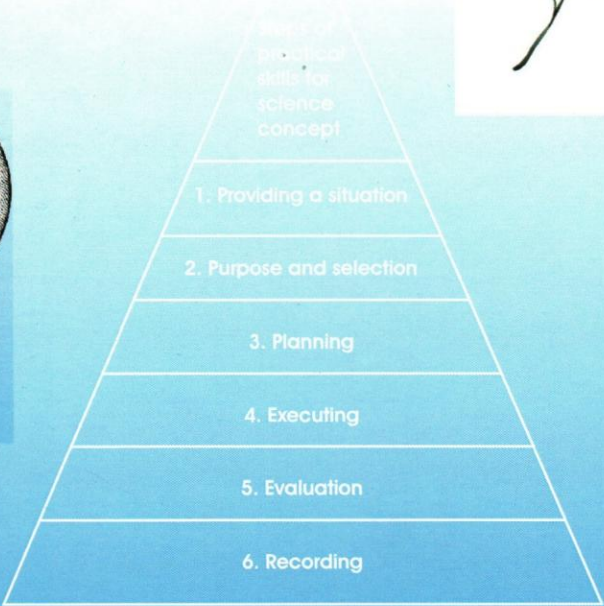
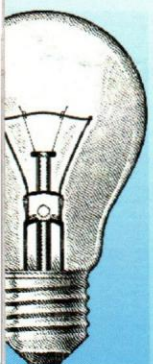
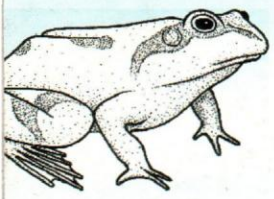
PROGRAMME CO-ORDINATOR

REGIONAL INSTITUTE OF EDUCATION (NCERT) BHOPAL (M.P.)

A constituent unit of National Council of Educational Research and Training, New Delhi



(NCERT) BHOPAL (M.P.)



REGIONAL INSTITUT

शिक्षार्थ आईए, सेवार्थ जाइए

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PREFACE

In the last two decades the impact of science and technology is visible everywhere. These recent innovative ideas in science have influenced every aspect of existence- vocational, social, economic, political and cultural. Science is intimately related to the means of production and means of communication. The exposure to science that students in our schools normally get creates in them an impression that science is a well settled body of facts, principle and theories. Even the laboratory work which they sometimes do consist of experiments set to a pattern, leading to results that are already known. With a little modification in approach however, the teacher can so design the experiences, that this weakness is removed from learners.

Science is a human endeavour which sharpens the mind through systematic and logical thinking. The practical skill inculcates many values in the learner. Noteworthy, among these are, reasoning ability, democratic and cooperative learning, accepting and rejecting the arguments on the basis of its merits and demerits, creative thinking and above all satisfaction of doing something. All these values generate confidence in the mind of the learners, which in turn helps the learner to become responsible citizen of the country.

The National Policy of Education (NPE) 1986, stresses the importance of science education, in these words, "science education will be strengthened so as to develop in the child well defined abilities and values such as spirit of enquiry, creativity, objectivity, the courage to ask questions and an aesthetic sensitivity". This enhanced responsibility can be adequately performed only when science teachers are equipped with required scientific competencies. Science teaching, as these are do not adequately develop the mastery of such competencies. It has, therefore, been emphasized that innovative approaches may be inducted into science clubs to sharpen the scientific competencies in both students and teachers. According to NCF-2005 teacher should act as a facilitator and not as a transformer of content where they can think, realize, analyze and develop their own way of learning which something beyond the text book.

Encouraging learners to carry out practical's would also help develop in them the scientific attitude with its emphasis on objectivity and open mindedness. The idea for practical skill may originate from something that has been taught in the class or read in a book or from of the general surroundings. Science can be learnt efficiently by experimentation. Abstract scientific principles can be understood and can be correlated with daily life experiences through activities and experiments. Though a science text book incorporates many activities but these activities are not being performed properly in the class rooms. Hence these activities need to be systematized and procedure of some important experiments must be formulated which will translate the basic scientific principles. The science teachers at school level must be trained properly to perform some basic experiments in order to inculcate scientific temperament and appreciation for science.

Use of the practical skills for science concepts may be helpful to understand several science terms.

Keeping in view the importance of practical skills in School education and particularly the Science education, the secondary stage was purposely chosen because it is felt that this is a most crucial stage for learners where the learner has to strengthen the knowledge gained at elementary stage and as well as build up right attitudes for the future life, which may make the learner a successful and confident human being in all walks of life. Considering these points of meaningful science learning using practical skills the objectives of training programme mentioned below-

1. To develop practical skills to make science subjects more creative and enjoyable.
2. To provide training on identified areas which need proper explanation through experimentation.
3. To facilitate systematic experimental procedure and inculcate meaningful scientific temper and scientific curiosity at secondary level.
4. To find out the feasibility and availability of, low cost apparatus and instruments.
5. Developing skills to perform some experiments using science kit developed by NCERT.

In order to achieve these objectives, in view this five days training programme was organized at RIE, Bhopal.

Dr. R. P. PRAJAPATI
Programme co-ordinator
RIE Bhopal

ACKNOWLEDGEMENT

I express my deep sense of gratitude to Prof. H. K. Senapaty, Director NCERT for their inspiring leadership which has always been a source of inspiration to accomplish the task in hand in a skilled and satisfactory manner. I would like to express my sincere gratitude to Prof. N. Pradhan , Principal, RIE, Bhopal for giving to me the opportunity and necessary support to complete training programme.

I would like to express my sincere thanks to Prof. I. B. Chugtai, Dean of Instruction, and Prof. V. K.Kakaria, Head DESM, RIE, Bhopal for continuous support and encouragement.

I am grateful to Prof. L.K. Tiwary, Head DEE, RIE, and Bhopal for his valuable help in organizing training programme.

I am also thankful to all resource persons, participants for their valuable support, discussion and suggestion for improvement of this programme.

Dr. R. P. PRAJAPATI

Programme co-ordinator

RIE, Bhopal

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**TRAINING ON PRACTICAL SKILLS IN SCIENCE USING SCIENCE KIT FOR
SECONDARY SCHOOL SCIENCE TEACHERS (PAC.16.43)
APPROACH PAPER**

Laboratory skill is an integral part of secondary level science curriculum. If properly planned and conducted, practical skills can provide a first hand experience of the various activities that comprise science. Practical skills are meant to (i) develop the skills required to perform the experiments and (ii) to strengthen the understanding of the theoretical concepts pertaining to the experiments done in the laboratory. The important skills required in science practical is meant to assist the learners to learn and develop the skills of manipulation, observation, reading, recording, computing and interpreting. Success achieved by following these skills not only trains one in these abilities, but also increases confidence in the method of science. Encouraging learners to carry out practicals would also help develop in them the scientific attitude with its emphasis on objectivity and open mindedness.

OBJECTIVE OF THE PROGRAMME

1. To develop practical skills to make science subjects more creative and enjoyable.
2. To provide training on identified areas which need proper explanation through experimentation.
3. To facilitate systematic experimental procedure and inculcate meaningful scientific temper and scientific curiosity at secondary level.
4. To find out the feasibility and availability of, low cost apparatus and instruments.
5. Developing skills to perform some experiments using science kit developed by NCERT.

Science can be learnt efficiently by experimentation. Abstract scientific principles can be understood and can be correlated with daily life experiences through activities and experiments. Though a science text book incorporates many activities but these activities are not being performed properly in the class rooms. Hence these activities used to be systematized and procedure of some important experiments must be formulated which will translate the basic scientific principles. The science teachers at secondary stage must be trained properly to perform some basic experiments in order to inculcate scientific temperament and appreciation for science. The main objective of this workshop is to develop the training package of practical skill in order to enrich the science teachers in learning the systematic performance of science experiments to relate the secondary science concepts effectively with practical skills.

Dr. R. P. PRAJAPATI

Programme co-ordinator

PRACTICALS SKILLS IN SCIENCE CONCEPTS

In the last two decades the impact of science and technology is visible everywhere. These recent innovative ideas in science have influenced every aspect of existence- vocational, social, economic, political and cultural. Science is intimately related to the means of production and means of communication. The exposure to science that students in our schools normally get creates in them an impression that science is a well settled body of facts, principle and theories. Even the laboratory work which they sometimes do consist of experiments set to a pattern, leading to results that are already known. With a little modification in approach however, the teacher can so design the experiences, that this weakness is removed from learners.

An experiment skill for science concepts on the other hand involves a search to understand the unknown and begins with a question. In doing the usual science concept for practical you report on, something that some one else has discovered. This does not mean that doing an experiment will earn you world- fame as a discoverer. It does mean that you can discover something, a fact or relationship that was unknown to you and that was not recorded in any book available to you. Scientists refer to this as an independent discovery.

The National Policy of Education (NPE) 1986, stresses the importance of science education, in these words, " science education will be strengthened so as to develop in the child well defined abilities and values such as spirit of enquiry, creativity, objectivity, the courage to ask questions and an aesthetic sensitivity". According to NCF-2005 teacher should acts as a facilitator and not as a transformer of content where they can think, realize, analyze and develop their own way of learning which something beyond the text book.

Laboratory skill is an integral part of school level science curriculum. If properly planned and conducted, practical skills can provide a first hand experience of the various activities that comprise science. Practical skills are meant to (i) develop the skills required to perform the experiments and (ii) to strengthen the understanding of the theoretical concepts pertaining to the experiments done in the laboratory. The important skills required in science practical are meant to assist the learners to learn and develop the skills of Manipulation- involve the correct and skillful handling of the apparatus by the experimenter. Observation- involves the use of senses Hearing, sight, touch and smell to detect changes/reactions. Reading- refers to the ability to comprehend written or printed information. Recording- entails writing down, for example,

measurements or statements of facts or other details for reference. Computation- the use and application of mathematical knowledge on the data collected Interpretation- studying the data collected and drawing conclusions based on the established science principles/theories. Success achieved by following these skills not only trains one in these abilities, but also increases

confidence in the method of science. Encouraging learners to carry out practical's would also help develop in them the scientific attitude with its emphasis on objectivity and open mindedness. The idea for practical skill may originate from something that has been taught in the class or read in a book or from of the general surroundings. Science can be learnt efficiently by experimentation. Abstract scientific principles can be understood and can be correlated with daily life experiences through activities and experiments. Though a science text book incorporates many activities but these activities are not being performed properly in the class rooms. Hence these activities need to be systematized and procedure of some important experiments must be formulated which will translate the basic scientific principles. The science teachers at school level must be trained properly to perform some basic experiments in order to inculcate scientific temperament and appreciation for science. Use of the practical skills for science concepts may be helpful to understand several science terms which include the following:

1. To stimulate an interest in science subjects.
2. To improve their experimental and communicational skills and to develop scientific attitude and interests.
3. To inculcate divergent thinking and cooperative attitude among the students.
4. To make science subjects more create enjoyable and a sound fundamental knowledge of facts and principles.
5. To satisfy scientific curiosity.
6. To encourage independent thinking.
7. To make use of environment.
8. To give practice in critical thinking.
9. To develop problem solving techniques.
10. To make scientific principles more meaningful.
11. To increase self-confidence.

The experiment should be so designed that its results are clearly interpretable. Interpretation becomes difficult if the variables are not identified and suitably controlled. The initial design of the experiment must be carefully looked into so that some of the possible sources of error can be located and steps taken in the design to correct. Before actually starting the experiment, a list of materials required must be prepared and all the materials procured according to the list. It would also be convenient if a method of recording the data has been decided upon, so that the necessary tables etc. , could be prepared before the experiment is started. During the experiment, accurate observations must be made and duly recorded, exactly as they happen. The data collected should be arranged in a methodical manner so that interpretations would be facilitated. The results and conclusions of the practical will have to be presented finally as a report. There are a number of ways in which the experiments can be modified and improved. If these practical skills can generate ideas not only for improvement of the suggested designs but also for new experiments, their purpose would be amply served. The steps involved in an experiment skill for science concept are:

1. PROVIDING A SITUATION- Experiment work almost always should be initiated by teachers. He/She should provide situations to the students which motivate to create some problem for them and in which they feel interested to work.

2. PURPOSE AND SELECTION- While selecting the experiment, for science concepts, the teacher should see that practical should be relevant to this level of skills. The objectives of practical should be clearly defined and understood by the students.

3. PLANNING- The success of a experiment work depends upon good planning. The students should plan out the whole scheme under the proper guidance of the teacher. After discussion of the practical work with teacher and group of students should write down the plan properly.

4. EXECUTING- The teacher should assign different tasks among the students of a group according to their interest and abilities. Every student should contribute actively towards the execution of the practical work and skill. Some of the student may be assigned the work of library to collect information about the experiment. The student who is good in laboratory work must be given the task to perform experiment and he/she can also collect the data. In the same way different tasks may be assigned to different students and teacher should give instructions wherever need be.

5. EVALUATION- Evaluation should be done in terms of objectives. The work must be judged by the teacher and it should be reviewed in terms of the error committed by the students. Each practical should be evaluated on its own merits, not in competition with other practical's and with the abilities, interest and back-ground of the student given full consideration.

6. RECORDING- The students should keep record of all the work i.e. how they planned, what discussion were held and finally criticism of their work and some key points for future reference.

Experiment skills for science concepts can make the study of science more exciting, enjoyable and educational. This provides an opportunity to teachers and learners to get a first hand experience of the process involved in scientific concepts at school level. It represents one method of helping learners, explore their special interests in depth. The resulting findings are often more valuable to the students who are involved than the information presented in regular class periods. The main objective of this workshop is to train a package on science concepts to promote the practical skills in order to enrich the science teachers and students in learning and systematic performance of science experiments to relate the science concepts effectively with experiment skills.

Dr. R. P. PRAJAPATI

Programme Co-ordinator

RIE, Bhopal

PROGRAMME REPORT

Laboratory skill is an integral part of school level science curriculum. If properly planned and conducted, experiment skills can provide a first hand experience of the various activities that comprise science. The National Policy of Education (NPE) 1986, stresses the importance of science education, in these words, "science education will be strengthened so as to develop in the child well defined abilities and values such as spirit of enquiry, creativity, objectivity, the courage to ask questions and an aesthetic sensitivity". According to NCF-2005 teacher should acts as a facilitator and not as a transformer of content where they can think, realize, analyze and develop their own way of learning which something beyond the text books.

Training programme on conducting practical skills of science using secondary science lab. Kit (PAC 16.43) was organized in RIE Bhopal from 18-22 Sep. 2017 for state of Western region States (Gujrat, Maharastra, Chattishgarh, Madhya Pradesh & Goa) science teacher (secondary).

TRAINING PROGRAMME (18-09-2017 to 22-09-2017)

The training programme began on 18th Sep. 2017. The letters were sent well in advance and authorities were also consulted telephonically. In spite of much effort only 27th teachers, out of 50 from Western region states registered for participation. During the inaugural session, the academic coordinator of the programme emphasized the need for the active involvement of the participants to derive the best out of the training programme. He called upon the participants to have a free academic interaction with resource persons so that they can project their problems and share their thoughts with regard to practical skills of science subjects. On the first day of the training programme in the second session, the resource persons had an informal interaction with the participants to explore their specific need to be met during the laboratory work. The discussions resulted in identifying the specific experiment which needs to be emphasized and doubts to be cleared during the discussions of those experiments. The participant attends the Chemistry, Physics and Biology laboratory sessions as per the training programme schedule. All participants were highly enthusiastic and actively involved themselves in the training programme. The resource person invited for training programme from 18th to 22^d September 2017 as per the list is given as follows:

REGIONAL INSTITUTE OF EDUCATION BHOPAL

**TRAINING ON PRACTICAL SKILLS IN SCIENCE USING SCIENCE KIT FOR
SECONDARY SCHOOL SCIENCE TEACHERS (PAC.16.43)**

FIVE DAYS TRAINING PROGRAMME (18-22 Sep. 2017)

LIST OF RESOURSE PERSONS

S. No.	NAME	ADDRESSES	EMAIL
1.	Dr. V. K. Kakaria Professor, Zoology	RIE ,Bhopal	kakaria.vinod97@gmail.com
2.	Dr. Jaydip Mandal Professor, Botany	RIE ,Bhopal	jaydipmandal07@yahoo.com
3.	Dr. L. K. Tiwary Professor, Chemistry	RIE ,Bhopal	lktiwary@yahoo.com
4.	Dr. Reeta Sharma Professor, Botany(Retired)	RIE ,Bhopal	reetasharma14@gmail.com
5.	Dr. I. P. Aggrawal Professor, Chemistry(Retired)	RIE ,Bhopal	ipaggrawal46@yahoo.com
6.	Dr. Rashmi Singhai Associate Professor, Chemistry	RIE ,Bhopal	ras-iv@erdiffmail.com
7.	Dr. Daksha Parmar Assistant Professor, Botany	RIE ,Bhopal	daksha_parmar@yahoo.com
8.	Dr. Rashmi Sharma Associate Professor, Chemistry	RIE ,Bhopal	rashminerie666@gmail.com
9.	Dr. Kalpana Maski Assistant Professor, Physics	RIE ,Bhopal	<u>k-maski@rediffmail.com</u>
10.	Mr. L. S. Chauhan Assistant Professor, Physics	RIE ,Bhopal	<u>shreelschauhan@gmail.com</u>
11.	Dr. Sabiha Kamal Khan Assistant Professor, Zoology	RIE ,Bhopal	<u>drsabiha.k@gmail.com</u>
12.	Dr. Sudhi Shrivastava Assistant Professor, Zoology	RIE ,Bhopal	<u>sudhishrivastav@yahoo.com</u>

13.	MM, Dr.M. Murlidhar Assistant Professor, Zoology	RIE ,Bhopal	drmmurlidhar@gmail.com
14.	LS Dr. Lokesh Shastri Assistant Professor, Physics	RIE ,Bhopal	lokeshshastri@gmail.com
15.	Sk,Dr. Sangeeta Kanakraj Assistant Professor ,Chemistry	RIE ,Bhopal	skskanakraj5@gmail.com
16.	Dr. R. P. Prajapati, Assistant Professor, Chemistry, Programme Co-ordinator	RIE ,Bhopal	prajapatirie@gmail.com

In this training programme all participants spent their entire time in Chemistry, Physics and Biology laboratories. The major techniques/experiments skills they learnt are as the programme included:

In Chemistry, 1. Reading of thermometers and stop watches .2.Weghing technique by chemical balance and maintenance of chemical balance 3. Handling of glassware's ,using, clamping and cleaning. 4. Preparation and properties of gases and setting up of apparatus for the preparation of gases.5. Determination of pH of different chemicals fruits and vegetables using litmus paper/pH paper/universal indicator and hand pH meter.5. Skill for preparation of soap 5. Titration by double burette method 6. Separation of coloured component by paper chromatography 7. Determination of specific properties of organic compound 8. Experimental properties related to metals and non-metals.9. Technique to prepare emulsion. 10. Technique involved in the study of evaporation, exothermic and endothermic reaction. **In Physics,** 1. Testing of electronic components 2. Fuse -testing, rating and fitting. 3. Series and parallel wiring.4. Reading circuit diagrams. 5. Identification of lenses and mirrors double convex and concave. 6. preparation of electronic circuit on the bread board. 7. Focal length of concave and convex lense.8 experiments on motion, slope and acceleration 9. Demonstration of Galileo's thought experiment.10. Error measurement and collection of real time data and position.11. Determination of fluid pressure by hydrometer.12. Working knowledge of electrical and electronic equipments, gravitation and Archimedes principle. **In Biology,** 1. Skill of aerobic respiration.2. Experiment on stomata activity.3. Demonstration of transportation in plants.4. Experiment on pigments of chloroplasts.5. Practical skills in mendelian genetics.6. Study of microscope part, handling and reading.7 Experiment on osmosis,meristematic tissue and spore formation in rhizopus.8. Demonstration of

flower structure, vegetative propagation, soil erosion and different soil samples. 9. Identification of monocot and dicot leaf. 10. Onion peel structure under the microscope.

The participants fully utilized the training package which was distributed to them just after their arrival in inauguration session. During the programme session they removed their doubts and misconceptions if any by discussion with the resource persons. The last sessions of 21st September 2017 were utilized to visit Regional Science Center, Bhopal. The education officer, Mr. Raut performed some interesting experiments which were much helpful to inculcate interest in science related to secondary & higher secondary levels.

All the participants enjoyed a lot in different experiment related to practical skills which were much helpful to inculcate interest in science, and also last day of programme all participants submitted their feedback report. They appreciated this programme and requested to organize similar programmes for longer duration.

The valedictory function of the training programme was held on 22-09-2017. Prof. Nityanand Pradhan Principal of RIE Bhopal, in his valedictory address, stressed the importance for such training programme and hoped that the participants would pass on the benefits derived to the students in their classrooms. Some of the participants, who spoke, expressed that the training programme was highly rewarding enrichment of practical skills. They lauded the efforts of programme coordinator, resource persons and their academic inputs. At the end of the programme, the participants were given certificates for having completed the training successfully.

FEEDBACK OF PARTICIPANTS

A feedback report was prepared in order to study the effectiveness of such programme. Before valedictory (22-09-2017), all participants were suggested to submit their feedback related to training programme. There was encouraging response from participants and all cooperated to submit their feedback report to programme coordinator.

All participants appreciated this kind of programme and suggested to organize this kind of programme in future for themselves as well as for other teacher. Inspired by these comments similar programme was proposed for the secondary science teachers of Gujarat, Maharashtra and Chhattisgarh states in coming session. The suggestion given by the participants summarized as follows:

1. Mostly all participants suggested organizing such training programme related to science experiment regularly for the benefit of practicing science subject teachers.
2. All participants found that five days duration of training programme insufficient to cover maximum areas of their difficulties related to science experiments. Looking into these difficulties similar programme proposed for (Gujarat, Maharashtra and Chhattisgarh states) the

next session has been scheduled to increase the duration of the programme, so that some more area of experiment skills will be covered and practices would be established effectively.

3. Some participants suggested sending the objectives of the programme and time table schedule to the participants well in advance so that they will attend with mental preparation to learn something they needed.

4. Mostly all participants appreciated this programme in understanding of minute problems coming across while performing experiments which are generally ignored by the teachers. Some participants requested to organize such programme during vacation so that the teaching in the schools will not be affected.

5. All participants were highly satisfied on the hospitality provided to them and in the same time they were very happy on the co-ordination and overall management of the programme.

All the suggestions furnished by the participants are accepted with positive attitude and will try to be accommodated in the similar programme proposed in the coming session for Gujarat, Maharashtra and Chhattisgarh states.

REGIONAL INSTITUTE OF EDUCATION BHOPAL
TRAINING ON PRACTICAL SKILLS IN SCIENCE USING SCIENCE KIT FOR
SECONDARY SCHOOL SCIENCE TEACHERS (PAC.16.43)

TRAINING SCHEDULE (18-22 Sep. 2017)

Day/Date	Time/Session I 09.30-11.00 AM	Time/Session II 11.15-12.45 AM	Time/Session III 01.15-03.15 PM	Time/Session IV 03.30-05.15 PM
18/09/17 Monday	Registration & Inauguration	Basic of practical Skills for Science IP/ LKT	Biology Practical JM/DP	Biology Practical VKK/SKK
19/09/17 Tuesday	Chemistry practical RPP/RS	Chemistry practical IP//RPP	Physics practical LSC/LS	Biology practical Reeta S/DP
20/09/17 Wednesday 7	Chemistry practical IP/R Sh	Physics practical KM/LSC	Biology practical Reeta S/ DP	Biology practical DP/Reeta S
21/09/17 Thursday	Biology practical VKK/MM	Chemistry practical IP/RS	Biology practical Reeta S/DP	Physics practical LSC/KM
22/09/16 Saturday	Biology practical Reeta S/SS	Physics practical KM/LSC	Chemistry practical IP/SK	Valedictory Session & Distribution of TA/DA

Tea Break-11.00-11.15AM & 03.15-03.30 PM, Lunch 12.45-01.15 PM

JM, Prof. Jaydeep Mandal

PK, Prof. P. Kulshretha

LKT Pprof. L. K. Tiwari

IP, Prof. I. P. Aggrawal

VK, Prof. V. K. Kakaria,

RS, Prof. Reeta Sharma

RS, Dr. Rashmi Singhai

DP, Dr. Daksha Parmar

KM, Dr. Kalpana Maski

LSC, Mr. Lokendra Singh Chauhan

SKK, Dr. Sabiha Kamal Khan

SS, Dr. Sudhi Shrivastava

MM, Dr. M. Murlidhar

LS Dr. Lokesh Shastri

Sk, Dr. Sangeeta Kanakraj

RPP, Dr. R. P. Prajapati

Lab. Assit. Hitesh (Zoology), Sanju (Physics), Sangeeta (Botany)

Dr. R. P. Prajapati

Programme Co-ordinator

RIE, Bhopal

REGIONAL INSTITUTE OF EDUCATION BHOPAL
TRAINING ON PRACTICAL SKILLS IN SCIENCE USING SCIENCE KIT FOR
SECONDARY SCHOOL SCIENCE TEACHERS (PAC.16.43)

LIST OF PARTICIPANTS Date: 18th to 22nd September, 2017

S. No.	NAME	ADDRESS	CONTACT NO.	EMAIL ADDRESS
1.	Deshmukh Hanmant Baburao	Sou. Tarabai Madhavrao Mohite Vidyalya, Rethere, Tal- Karod, Dist Satara, MH	9881584377	hanamantdeshmukhsir@gmail.com
2	Somade Ashok Maruti	Chhatrapati Sambhaji Vidyalaya, Shivnagar, Tal-Karad, Dist. Satara	9850682329	ashoksomade@gmail.com
3	Kondawde Sanjay Sopan	Chhatrapati Shahu Maharaj Madhyamik Vidyalya, Khopoli, Tal- Khalapur, Dist. Rajgad	9822619048	sanjaykondawale730@gmail.com
4.	Khan Majeed Wahed	Late Radhabai B Wankhede School, Phulamtri, Dist Aurangabad, MH	9822513114	aleenazahed@gmail.com
5	Thombare Dajrba	Dajrba Shahajirao Janata Vid. Khopoli, Dist. Rajgad	9420961080	dajrbhat@gmail.com
6	Rohini Rangnath Mali	DIECPD, Vaijapur, Dist Aurangabad, MH	8788206958	rohini r mali@gmail.com
7	Suhas Vasant Patil	Ravindranath Tagore Madhyamik Vidyalya, Samarth Nagar, Aurangabad, MH	8149166563	jsvpatil128@gmail.com

8.	Navnit Rangrao Sapkale	P.R. High Dharangaon At. Po. Tal Dharangaon, Dist. Jalgaon, MH	9403285128	navnitsapkale@gmail.com
9	Ravindra Yuvaraj Chaudhari	Vanajivan Vidyalya Pachora, Tal. Pachora Dist. Jalgaon, MH	9028685054	ravi.chaudhari157@gmail.com
10	Padum Lal Nayak	Govt. H.S.S. Sankara (Jonk) BEO, Pithora, Dist. Mahasamund, C.G.	9424232361	--
11	Kaushal Kumar Chandrakar	Govt. H S S. Mungaser, Block - Bagbahra, Dist. Mahasamund, C.G.	9977646016	kaushalchandrakar7@gmail.com
12	Prakash Kumar Chandrakar	Govt. H.S S Parkhanda, Block - Khurd, Dist. Dhamtari, C G	7000709700	pchandrakar1234@gmail.com
13	Rajeev Lochan Sahu	Govt. H.S.S. Basantala, Block - Kunkuri, Dist. Jashpur, C.G.	9691326408	-
14	Dipti C S Bisht	Regional Academic Authority (SISE) Ravinagar, Nagpur, MH	9422104525	diptibisht129@gmail.com
15	Jyoti M Medpilwar	Regional Academic Authority (SISE) Ravinagar, Nagpur, MH	9766316837	jmmedpilwar41065@gmail.com
16	Rajendra Yadaorao Chaudhari	Model High School, Nandpur, Tah-Arvi Dist Wardha, MH	9421726546	rajendra3565@gmail.com
17	Anil Ratilal Mali	Modern Education Society's Secondary School, Old Cidco	9850818644	anilmali@yahoo.co.in

		NASHIK, MH		
18	Rajenrakumar S. Prajapati	Kasturba Kanya Vidyalaya, D.N. Campus , Station Road, Anand, Gujarat	9824490193	rajendrabhaiprajapati@gmail.com
19.	Nitin Kumar K. Shah	N.K. High School, Sadar Chowk, Petled	9409402723	nitinshah@yahoo.co.in
20	Vishnubahi C. Patel	Kameshwar Vidyalaya, Satelliter Ahmedabad, Gujarat	9429068080	we_see_patel@yahoo.co.in
21	Mazhar Khan S. Pathan	Govt. Sec. High School, Juhapura, Fatehwadi, Ahmedabad Rural, Ahmedabad, SS	9510356141	pathanmazhar1@gmail.com
22	Gun Mahmadafaizal Rashulbhai	Govt. Model School, Bhojva, Ta. Viramgam, Di. Ahmedabad (Rural)	9824123693	faizul.personal.doc@gmail.com
23	Vinayak Vishwanath Tathod	Shri. Ramkrishna Vidhyalya, Kandli (Paratwada) Ta: Achapur, Dist. Amrawati	9420832573	vinayak.tathod@gmail.com
24	Smt. Sunita Pandey	Govt. H.S.S. Godhi, Raipur, C G.	7772020489	pandeyunita4869@gmail.com
25	Smt. Madhu Naik	Govt. H.S.S. Seoni, Raipur, C G.	9685631298	mnaik1811@gmail.com
26	Smt Kumkum Jha	Govt. H.S.S Pond, Raipur, C.G.	9827130291	kumkum.jha173@gmail.com
27.	Dr Jitendra Kumar Sharma	Govt. H.S.S. Khauli, Raipur, C G	9993325049	jitendrakusharma@gmail.com