

**WINTER INSTITUTE IN PHYSICS
FOR
TEACHERS OF JUNIOR COLLEGES OF KARNATAKA**

21st November to 10th December 1988

A REPORT



**REGIONAL COLLEGE OF EDUCATION, MYSORE-570 006
(NCERT)**

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TEACHERS OF JUNIOR COLLEGES OF KARNATAKA**

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Regional College of Education, Mysore 570 006 (NCERT)

RESOURCE PERSONS

1. *Dr.S.G.Gangoli - Academic Co-ordinator, (Regional College of Education)*
2. *Sri P.R.Rao* (RCE)
3. *Dr.N.N.Swamy* (RCE)
4. *Sri L.Rameshchandra (Sharada Vilas College (Retd.))*
5. *Sri K.V.Araknath (Sharada Vilas College (Retd.))*

EXTENSION WORK

Dr.V.Ramachandra Rao (RCE)

CONSULTANT

Prof. A. N. Maheshwari (RCE)

WINTER INSTITUTE IN PHYSICS - AN INTRODUCTION

- S.G.Gangoli

The project on Improvement of Science Education in Schools is an important step in the implementation of the National Education Policy (1986). It is aimed at improving Science Education at middle, secondary and higher secondary (PUC) stages. The project provides grants for -

- a)purchasing laboratory equipments
- b)procuring books for the library
- c)development of resource centers
- d)innovative educational projects
- e)in-service training programmes for
 - (i)teachers (ii)resource persons and (iii)key persons.

The Winter Institute was organised to impart in-service training to physics lecturers of junior colleges in Karnataka.

Planning for the Institute

This institute was originally scheduled for the summer of 1988, and accordingly the Director of the State Institute of Science Education was contacted. But it had to be postponed as desired by the State Institute till winter 1988.

This Institute was primarily aimed to:

1. enrich content areas
2. develop skills to carry out practicals
3. fabricate and use improvised apparatus

4. familiarize with the methods of continuous and objective evaluation
5. highlight different educational methodologies
6. familiarize with the use of educational technology
7. highlight some of the objectives of the NEP, such as
 - a) use of science for the welfare of the society
 - b) appreciating the contributions of Indian Scientists.

The proposed dates of the Institute were from 21-11-88 to 10-12-88. This was confirmed on receipt of the list of participants in the second week of November 1988. A meeting of the Physics section was called on 17-11-88. Many members expressed their inability to participate in this Institute due to their commitment to other programmes of the college. Following arrangement was agreed.

Dr.S.G.Gangoli (Academic Co-ordinator)

Shri P.R.Rao - Resource Person

Dr.N.N.Swamy (for first two weeks) - Resource person

Dr.P.R.Lalitha, Dr.(Miss)Anantha Lakshmi and Shri N.R.Nagaraja Rao agreed to participate during the first week.

It was decided that some resource persons from outside be associated with this institute. Accordingly, Shri L.Ramesh Chandra and Shri Arknath K.V. retired Professors of Sharada Vilas College, Mysore, were contacted and they very kindly agreed to spare as much time as possible during the course of this institute. It was suggested that the topics to be discussed in the institute be finalised after consulting the participants.

Dr.V.Ramachandra Rao, incharge of the extension department kindly agreed to take care of the administrative aspects such as contacting the state departments, getting necessary financial sanctions, lodging and boarding arrangements and other day to day arrangements for the conduct of the institute. We are very grateful to him for the same.

It was suggested that the resources available in the college be tapped for the benefit of the participants. Accordingly Dr.Raghavan, Coordinator, Computer Centre, Dr.Tantry, incharge Audio/video studio and Shri Sitaramaswamy, Librarian were contacted.

The participants of the Institute were 33 Lecturers in Physics of the Junior Colleges of Karnataka. Their names and addresses are given in Appendix I.

Conduct of the Institute

The institute was formally inaugurated by Prof.A.N.Maheshwari, Principal, Regional College of Education, Mysore on 21-11-88. Shri Ravindra Nath, Director, State Institute of Science Education kindly graced the occasion. After Prof.S.N.Datta welcomed the participants. Dr.S.G.Gangoli explained the objectives of the Institute and how it is hoped to achieve them. Quoting the example of Sir C.V.Raman, Prof.Maheshwari explained how great things can be done with ordinary facilities, if only one has keen interest in it. Shri Ravindra Nath explained with what great difficulty he has managed to finance the payment of T.A. and D.A. to the participants inspite of tight position and stressed that the participants are expected to justify this expenditure. Dr.V.Ramachandra Rao, Incharge Extension proposed the vote of thanks.

The institute functioned from 10 a.m. to 5 p.m. with an hour's lunch break. The details of the entire programme is given in the Appendix 2.

The institute programmes along with the weightage allotted can be classified as under :

- a) Lecture cum discussion by the participants (15%)
- b) Lecture cum discussion by resource persons and guest lectures (30%) .
- c) Computer awareness programme (4%)
- d) Films (8%)
- e) Demonstration experiments (8%)
- f) Laboratory experiments (20%)
- g) Library consultancy (10%)
- h) Evaluation (3%)

Initially on the basis of group discussion and evaluatory tests, topics for elaborations were listed. Some of these topics were assigned to the participating teachers. They prepared their lectures in consultation with the resource persons. Remaining topics listed were assigned to resource persons and guest lectures. In both the cases detailed discussions followed the actual lectures. Most of these lectures were supported by suitable PSSC films besides some films prepared by UGC and NCERT.

Some of the sophisticated experiments were set-up by the resource persons and demonstrated to the teachers. Besides the teachers actually performed large number of experiments which they can actually try out in their schools.

Participants - expectations and impressions

The director of the State Institute of Science Education had in the valadictory function impressed upon the participants that they should work with right earnestness and get maximum benefit from the programmes. The initial pre-test conducted and the fact that they have to deliver one lecture themselves made the participants attend to their tasks quite seriously with all earnestness.

At the end of the programme, the participants were given an evaluation Test. It consisted of fourty objective type multiple choice questions. These questions covered the topics discussed in the class-room and laboratories. It was encouraging to note that the performance of the participants was very encouraging and this proved that they took the programme quite seriously and greatly benefited by it.

The questionnaire to gather their impressions circulated among the participants covered the following aspects :

- a) Objectives of the institute
- b) Topics to be covered
- c) Aspects they found more useful
- d) Physical facilities in the institute
- e) Suggestions for improvement.

Their expectations and impressions may be briefly summarised as follows :

a) The objectives of the institute should be prioritywise

- i) To improve method of teaching physics at PUC level
- ii) To familiarise with the use of audiovisual aids
- iii) To get acquainted with the latest development in Physics.

These objectives according to them were achieved for a large extent.

b) They suggested indepth coverage of some topics like polarisation, semiconductors, A.C. metres. They listed the following programmes of the institute in order of usefulness.

- c)
 - i) P.S.S.C. film
 - ii) Laboratory work and
 - iii) Lectures by resource persons.

d) They wanted that the institute should be of 15 days duration.

e) They wanted better boarding facilities.

The institute concluded with the valedictory function on 10.1.1989. The highlights of which were as under :

After the welcome address by Prof. Somnath Datta, Dr. Gangoli gave a detailed account of proceedings of the institute. Some participants recalled their experiences and impressions of the institute and made suggestions for its improvements. Prof. K. Gopal from the department of Physics, Mysore University, spoke on the role of demonstration activities in the teaching of Physics. Prof. Maheshwari spoke on the desirability of co-ordinal relation between the teachers and the students and narrated his own experiences with his Professor S.Chandrashekar, the Nobel Lauratte. The function concluded with a vote of thanks by P.R.Rao.

DISCUSSIONS ON SELECTED TOPICS - S.G.Gangoli

Lecture cum demonstrations have a major role in any content enrichment programme. They

- a) remind the participants of what they had learnt
- b) enrich certain areas which the participants are not quite familiar with
- c) enable the participants to learn new topics
- d) highlight the methodology an experienced teacher follows to teach a topic
- e) demonstrate the use of teaching aid in delivering the lectures.

So it is necessary that the list of lecture topics be carefully prepared. In this institute this list was prepared on the basis of the following : The pre-test results clearly indicated the participants need a thorough exposure in certain areas. Next the participants as well as the P.U.C. syllabus were divided into four groups. After detailed group discussions a list of topics that need enrichment was prepared. Besides, the participants gave a list of topics of general interest that they wanted to know about.

Having thus prepared a list of topics that have to be covered in the institute a two-fold approach was followed. First the teachers themselves were asked to choose topics in the list and give lectures. It was encouraging that about 40% of the topics were selected by the participants themselves. They were then taken to the library and suitable books were issued to them. They discussed the topics with the resource persons and prepared their lectures. The resource persons also helped them during the discussions that followed the lectures. This helped teachers to clarify many of the difficulties they come across in the classroom and enabled the resource persons to judge the background knowledge of the participants. It also gave confidence to the participants to learn things on their own.

Remaining 60% of the topics were covered by resource persons and guest lecturers.. It gives us great pleasure to record our gratitude to the following guest lecturers for sparing their valuable time and delivery lectures.

1. Prof. A.N.Maheshwari - Principal, RCE, Mysore.
2. Prof. H.Krishnamurthy, Department of Physics,
Mysore University.
3. Dr. G.K.Vishwanath - Reader in Physics,
Maharani's College, Mysore.
4. Prof. Somnath Datta - RCE, Mysore.
5. Dr. S.N.Prasad - Reader in Physics, RCE, Mysore.

The large number of lectures that were delivered in this institute can be broadly divided into four groups. The names of the specific topics of the lectures under different groups & its speakers are listed below:

Group I : Mechanics and General Physics

Weightlessness (N.N.Swamy)
Newtons III Law of Motion (S.N.Dutta)
Vectors (Anandhthirtha)
Centrifugal force (S.N.Dutta)
Gravitation - PSSC treatment (Patter)
Viscosity (Ramachandra Murthy)
Angular Momentum (S.N.Dutta)
Energy - PSSC treatment (Uppar)
Errors and significant figures (P.R.Rao)
Unified Theory of forces (A.N.Maheshwari)
Physics of space travel (S.N.Prasad)

Group II : Waves & Wave propagation

Introduction to Waves (S.G.Gangoli)

Wave propagation (Chatra)

Fermats principles (Prabhakar)

Las ers (S.G.Gangoli)

Fraunhofer diffraction (Vishwanath)

Intensity of Sound (K.V.Murthy)

Doppler effect (M.V.Siddalingaiah)

Ultrasonics (S.G.Gangoli)

Fresnel diffraction (S.G.Gangoli)

Group III: Heat, Thermodynamics and Modern Physics

I & II Laws of Thermodynamics (Ram eshchandra)

Radioactivity (Aithal)

Thermistors (Araknath)

Semi conductors (Shivaj Rao)

Super- conductivity (Rooparani)

Quantisation of Atomic Spectra (A.N.Maheshwari)

Photo- electric effect (Araknath)

Band Theory & Solid (D.Krishnamurthy)

Super- conductivity (G.K.Vishwanath)

Detection of ionifing radiations (G.K.Vishwanath)

Nuclear reactors (P.R.Rao)

Detection of ionizing radiation (C.Vishwanath)

Group IV : Electricity Magnetism and Electronics

Gauss law in Electrostatics (Araknath)

B and H vectors (Nagaraja)

Moving charges (Balasubramanyam)

Electric and Magnetic fields (Chowdappa)

Thermo Electricity (Ramalakshamma)

E.M. radiations (Ramesh chandra)

Dia-pa-ro and Ferro Magnetism (H.Krishnamurthy)

A.C.Circuits (Araknath)

B and H vectors (Ramesh Chandra)

It is encouraging to note that the general performance of the teachers in the post-test on the topics discussed in the institute was excellent. The teachers were unanimous that they benefited by this programme and according to them they benefited more by learning about the methodology of teaching at the PUC level than by the Physics content of the lectures.

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LABORATORY WORK AND DEMONSTRATION EXPERIMENTS

- N.N. Swamy

The following laboratory experiments included in the PUC syllabus of Karnataka were set up at the request of the participants. All participants performed these experiments. This experience will enable them not only to procure the necessary equipments but also conduct the practical classes for the students effectively.

1. Measurement of inductance using A.C. and D.C. meters.
2. Temperature coefficient of thermistors using a PO Box.
3. Junction diode characteristics.
4. Thermo e.m.f. using a Potentiometer.
5. The concept of Half-life by measuring the rate of flow of water from a burette.
6. Measurement of the angle of dip using a Dip circle.
7. Mechanical advantage of an inclined plane.
8. Temperature coefficient of resistance using a P.O. Box.

The following experiments were demonstrated as a supplement to lectures on respective topics.

1. Laser - Diffraction at a single slit, double slit, and grating.
Interference using two slits.
2. Ripple tank - Wave characteristics, frequency, wave length, refraction, reflection, interference & diffraction.
3. Young's expt. - Interference and diffraction pattern using straight filament lamp & red filter.
4. Fraunhofer lines - using a spectrometer and grating.
5. Arc spectrum using a constant deviation spectrograph.
6. Discharge tube phenomena using a discharge tube and vacuum pump.
7. Measurement of magnetic induction in fundamental units.

These experiments were very much appreciated by the participants. It is noteworthy that though these experiments were listed in their syllabus many of them had not conducted most of the above experiments in their classes. The absence of external practical examination for the PUC is probably largely responsible for this state of affairs. Many teachers attributed it also to meagre resources and poor laboratory facilities in their schools.

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USE OF EDUCATION TECHNOLOGY IN LEARNING

- P.R.Rao

A. Audio-visual Education

During the course of the Winter Institute a large number of films (mostly P.S.S.C.) were screened and discussed. These films not only supplemented the lectures and demonstrations on some difficult topics but also illustrated how a good teacher presents a difficult topic to the class. Before screening a brief introduction as to 'what is the film about' was given. Screening of the film was followed by a detailed discussion on the content and methodology used in the film. The following are some of the important films screened.

1. Coulomb's law : Besides explaining the Coulomb's law this film illustrated (i) the characteristics of a "model" teacher (ii) the improvised apparatus to study coulomb's law in electrostatics (iii) how the approach to teaching should depend on the so called "steps in the methods of science" (In this film, experiments are performed which demonstrate that the force between two charges is proportional to the product of the charges and varies inversely as the square of the distance between them using an improvised apparatus).

2. Periodic Motion : The film concerns itself with simple harmonic motion - an exceedingly important example of periodic motion.

3. Frames of Reference : This film displays experimentally the visual presentation of motions (generally hard to visualize) from various reference frames i.e., frames of reference moving relative to one another. The idea of 'fictitious forces' is introduced through demonstrations of motions relative to inertial and accelerated frames of reference.

4. Ripple tank - I : This film displays the phenomena of reflection, refraction, dispersion, spherical and chromatic aberrations by employing waves on surface of water in a ripple tank.

5. Ripple tank - II : This film displays the phenomena of (i) diffraction patterns obtained using obstacles and single, double and multiple openings. (ii) interference and diffraction pattern obtained using a double slit.

6. Millikans Experiment : The film illustrates that charge comes in multiples of a natural unit, employing a small plastic sphere of known mass - the charge on it being varied using x-rays and its terminal velocity being measured in each case.

7. Photo-electric effect : The film is concerned with (i) qualitative experiments demonstrating that sunlight or light from a carbon arc falling on a metallic surface may eject electrons.

(ii) quantitative experiment to establish the relation between the max. K.E. of photoelectrons and the frequency of the incident light. Film concludes that the light rays comes in packets $h\nu$ in size (Photons)

8. Mass of an electron : In this film the mass of the electron is determined from its motion in a cathode-ray tube placed in the magnetic field produced by two long, parallel wires. The highlight of the film is the simple way of measuring the radius of the path of the electrons in the magnetic field by employing the shadow of a gramophone disc by a source of light.

9. Periodic Table : The film was screened in our Audio-video studio. It was a recorded version of the UGC film on periodic Table. It was screened to highlight how a television can be used to show parts of a recorded film intermittently to make the lesson more interesting. We thank Dr. K.N.Tantry, Incharge A.V. Studio for familiarising the participants with the role of Audio-visual aids in learning.

B. Computer Education :

We thank Dr. S.S.Raghavan, Coordinator, Computer Education for engaging two afternoon sessions and giving lecture demonstrations to highlight the role of Computers in education.

In the first session, a simulation software on "Moving molecules" which illustrates concepts in the Kinetic theory of gases, and another on "Bouncing Ball" for a detailed study of Projectile motion, were shown. A software package on "Semiconductors" was also demonstrated to the teachers.

How a computer could be used as a laboratory aid was the topic for discussion during the second session. A computer interfaced experiment on "Free fall" was then demonstrated.

The participants were asked to compute the value of acceleration due to gravity and verify the principle of conservation of energy from the data collected by the computer.

WINTER INSTITUTE OF PHYSICS

List of participants

1. Ananda Thirthachar P.
Lecturer
Municipal Comp. Pre University College
Gadag (Dharwar)
2. Laxminarayana Chatra A.
Lecturer in Physics
Viveka P.U. College
KOTA (D.K.)
3. Shankara Narayana Aithal K.
Lecturer in Physics
National Pre-University College
BAARKUR (D.K.)
4. Thimma Reddy A.P.
Lecturer
A & B Govt. Pre University College
Anekal (Bangalore)
5. Pattar S.K.
Lecturer in Physics
H.V. Camp
Pre University College
HARUGERI (Belgaum)
6. Angadi S.K.
Lecturer in Physics
S VP J College
Tiptur (Tumkur)
7. Shivaji Rao
Lecturer in Physics
Vijaya Pre University College
Pandavapura (Mandya)
8. Hanchinal S.F.
Lecturer in Physics
Govt. Pre University College
Shikaripur (Shimoga)

9. Uppar S.N.
Lecturer in Physics
Government Pre University College
Savanur (Dharwar)
10. Siddagangaiah M.V.
Lecturer in Physics
Govt. Pre University College
Koratagere (Tumkur)
11. Govindaraju R.
Lecturer in Physics
Kalidasa Pre University College
Tumkur
12. Balasubramanya S.
Lecturer in Physics
SRA Pre University College
Gubbi (Tumkur)
13. Marulasiddappa B.
Lecturer in Physics
Govt. Pre University College
Koppa
14. Murthy K.V.
Lecturer in Physics
Govt. Pre University College for Boys
Channapatna (Bangalore)
15. Rooparani V.H.
Lecturer
Sarvodaya Jr. College
Tumkur
16. Ramalakshamma H.P.
Lecturer
Govt. Jr. College
H.D. Kote (Mysore)
17. Sumithra M.G.
Lecturer in Physics
18. Reddappa C.
Lecturer in Physics
Govt. Pre University College
Chikamagalur

19. Ananda V.
Lecturer in Physics
Govt. Pre University College for Girls
13th Cross, Malleswaram
Bangalore
20. Jayaramu B.
Lecturer in Physics
Govt. Pre University College
Madhugiri (Tumkur)
21. Ramachandramurthy K.L.
Lecturer in Physics
Govt. Pre University College
K.R.Pet (Mandya)
22. Kulkarni B.R.
Lecturer in Physics
Govt. Pre University College
Byadgi (Dharwar)
23. Siddagangaiah A.
Lecturer in Physics
Vivekananda Pre University College
Tumkur
24. Nagaraju W.
Lecturer in Physics
Govt. Pre University College
Molakalmuru
(Chitradurga)
25. Syed Kazim Ali
Lecturer in Physics
Govt. Pre University College for Boys
Bidar
26. Renukaiah C.
Lecturer in Physics
Sri Siddaganga Pre University College
B.H.Road
Tumkur
27. Subbaramaiah
Lecturer in Physics
Govt. Pre University College
Hoskote
(Bangalore)

28. Chakrapani Udupa M.
Principal
Poornaprajna Pre University College
Admar (D.K.)
29. Basavaraja B.G.
Lecturer in Physics
Govt. Pre University College
Amruthur (Tumkur)
30. Viswanatha C.
Lecturer in Physics
Govt. Pre University College
Tumkur
31. Nagarathna S.
Lecturer in Physics
Govt. Pre University College
Gubbi (Tumkur)
32. Prabhakara S.N.
PGT in Physics
Demonstration School
Regional College of Education
Mysore-570 006
33. Chowdappa C.
Lecturer in Physics
Govt. Pre University College
Old Fort, Chamarajpet
Bangalore 18

Appendix II

WINTER INSTITUTE IN PHYSICS

Programme particulars

DATE	FORENOON	AFTERNOON
21.11.88 Monday	Registration Inauguration	Evaluation - Test Listing of difficulties Group work.
22.11.88 Tuesday	Approach to Teaching Physics - using film on Coulomb's law (P.R.Rao) Introduction to Waves (Gangoli)	Role of Laboratory work (P.R.Rao) Periodic Motion (film)
23.11.88 Wednesday	Weightlessness (N.N.Swamy) Gauss law in Electrostatics (Araknath)	Assignment (Library)
24.11.88 Thursday	Newtons Third Law of Motion (Datta) Discussion of Pre-test (Gangoli)	Laboratory work, optical phenomena, demonstrations using Lasers, Ripple- tank and Youngs interference expt. Fraunhofer lines in solar spectra - Arc spectra.
25.11.88 Friday	Vectors (Anandatirtha) Centrifugal force (Datta) Frames of reference (film)	- do -
26.11.88 Saturday	Thermistors (Araknath) Wave propagation (Chatra) Winter Institute in Chemistry (Banerjee)	Demonstration of measurement of B (P.R.Rao) Band H Vectors (Nagaraja) Assignment (Library)
27.11.88 Sunday	Assignments.	
28.11.88 Monday	First and Second Law of Thermo- dynamics (Ram eshchandra) Gravitation (PSSC treatment) (Pattar) Fermat's principle (Prabhakar)	Use of Computers in Physical Education (Raghavan)
29.11.88	Lasers (Gangoli) Kirchaff's Law of Electricity (Reddy) Radioactivity (Aithal)	- do -

30.11.88 Wednesday	Viscosity (Ramachandra Murthy)	<u>Lab session</u>
	Fraunhofer Diffraction (Vishwanath)	1. Measurement of inductance
	Moving charges (Balasubramanyam)	2. Temp. Coef. of Thermistors
		3. Junction diode characteristics
		4. Thermo- e.m.f.
		5. Flow of water with changing pressure
		6. a) Dip-circle
		b) Series & parallel combination of resistance metre bridge
		7. Inclined plane
		8. Temp. Coef. of conductor using P.O.B.
1.12.88 Thursday	Role of cassettes and Television in Education (Tantry)	- do -
	Intensity of sound (K.V. Murthy)	
	Semiconductors (Shivaji Rao)	Film Ripple tank-I
2.12.88 Friday	Angular Momentum (Datta)	Film Ripple tank-II
	Electric & Magnetic fields (Chowdappa)	
	Absolute Scale of temperature (Siddalingaiah A.)	
3.12.88 Saturday	Doppler Effect (Siddalingaiah M.V.)	Lab work.
	E & M Thermo electricity (Ramalakshamma)	
	Super conductivity (Rooparani)	- do -
	Mechanics- Discussion (Datta)	
	Energy (PSSC Treatment) (Uppar)	
4.12.88 Sunday	Assignments	
5.12.88 Monday	Quantisation in Atomic Spectra (Maheshwari)	- do -
	E.M. Radiations (Rameshchandra)	
	Errors and sig figures (P.R. Rao)	Film: Millikan's experiment
6.12.88 Tuesday	Dia, para and Ferro Magnetism (Krishnamurthy)	Lab work
	Photo- electric effect (Araknath)	Photo electric effect (film)
	Demonstration on Discharge through gases (Swamy)	
7.12.88 Wednesday	Band Theory of solid (Krishnamurthy)	Lab work.
	Super conductivity (Vishwanath)	
	Ultrasonics (Gangoli)	

8.12.88 Thursday	Unified theory of forces (Maheshwari)	Lab work
	Detection of ionizing radiations (Vishwanath)	Mass of an electron (film)
	B & H Vectors (Ramachandra)	Lab work
0.12.88 Friday	Physics of Space Travel (Prasad)	- do -
	A.C.Circuits (Araknath)	- do -
	Nuclear reactors (P.R.Rao)	Evaluation (Post-test) Nuclear reactors (P.R.Rao)
10.12.88 Saturday	Fresnel Diffraction (Gangoli)	
	Impressions - written (participants)	
	Valedictory function.	

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