THE INSTITUTION OF TELECOMMUNICATION ENGINEERS New Delhi

THE ANNUAL REPORT 1961-62



NEW DELHI 1962

NINTH ANNUAL GENERAL MEETING OF THE INSTITUTION OF TELECOMMUNICATION ENGINEERS

INAUGURATION

By

Shri JAGJIVAN RAM

MINISTER FOR TRANSPORT AND COMMUNICATION, GOVERNMENT OF INDIA

AT THE

Indian Standards Institution, Mathura Road, New Delhi.

Programme

December 7, 1962 :

16-30	hours	Business Meeting
17-30	hours	Tea
17-45	hours	Arrival of the Chief Guest
18-00	hours	INAUGURATION
		1. Address of Welcome by Dr. Lal C. Verman
		2. Inaugural Address by Shri JAGJIVAN RAM
		3. Presidential Address by JAGDEESH PRASAD

4. Vote of Thanks.

20-15, hours Annual Dinner at Constitution Club, New Delhi

(Chief Guest : Shri JAGJIVAN RAM)

TECHNICAL CONVENTION

December 8 and 9, 1962 :

Conference Hall, Indian Standards Institution

09-30	hours-13-00	hours	Morning	Session
14-00	hours-17-30	hours	Evening	Session

EXHIBITION OF ELECTRONIC COMPONENTS December 7, 8 and 9, 1962 :

> Museum Hall, Indian Standards Institution 10-00 hours-17-00 hours.

PREFACE

The Institution of Telecommunication Engineers has been in existence for just nine years. It is a very small period in the life of an Institution. But these are the years of utmost significance to the growth of an organisation. The stability of an Institution, the fulfilment of the aims and objectives it professes to safeguard and the impact upon the profession it caters for, are put to acid test during these formative years. If an Institution comes out successfully through these trials and tribulations, it is destined to flourish; otherwise it simply disappears.

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We have had all the anxiety, misgivings, excitement and adventure during these last few years. Thanks to the willing co-operation from all interested in the profession of telecommunication engineering, hardwork put in by the office bearers and the officials of the Secretariat and ungrudging help given by the Government, the Institution has, we are glad to find, not only stabilised its position but has made significant progress during the year under review. There has been a record increase of more than 1000 members in the membership of the Institution during the year. A well equipped library has come into existence by a generous grant from the Ministry of Scientific Research and Cultural Affairs, Telecommunication Tutorial Colleges have been opened at five places in India, viz. Bangalore, Bombay, Delhi, Jabalpur and Poona by the Ministry of Defence for imparting part-time training to the student members of the Institution for preparing for its Graduateship examination. Additional centres of examination are being opened at Agra, Hyderabad and Lucknow to accommodate large number of students appearing for the examination. Papers received for publication have been so numerous that nearly half the number, to be published during the year, has to be kept pending till the next year.

However promising all the above achievements may indicate, we are well aware that much more is yet to be achieved and constant efforts are called for to build our Institution on a solid foundation. We would request our members to come forward with suggestions for improvement, tell us our lapses and lend whole-hearted support to make our Institution a really worthwhile one.

> S. N. MITRA Honorary Secretary

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ANNUAL REPORT FOR THE YEAR 1961-62

1. INTRODUCTION :

The Institution of Telecommunication Engineers owes its origin to the realisation of the vital and ever-increasing role played by telecommunication engineering in the rapid progress in all fields of development eversince independence. The Institution came into existence in 1953 through the spontaneous initiative of leaders and pioneers in the field of telecommunication engineering. It had an auspicious start, being inaugurated by the President of India, Dr. S. Radhakrishnan and the time of the inauguration coinciding with the Centenary Celebrations of the Indian Posts & Telegraphs Department. The Institution encompasses, besides purely telecommunication fields, such as, telephony, telegraphy, radio, television etc., all others in the field of electronics and radiophysics so important in today's world of industrial controls, space exploration and automation. The platform it provides brings together communication and electronic engineers as well as radiophysicists from every line of specialisation to present their findings and discuss their problems. It also provides facilities for training of young engineers through the Graduateship Examination.

India has launched an impressive programme of development in telecommunication engineering, television, industrial production and technology. The Institution has an immense task ahead to serve the country in particular, and to participate in the progress and advancement of the field of telecommunication engineering in world in general, through journals and other publications. In this and multifarious other activities, the Institution came across many difficulties, particularly in its initial stages of formation which have been, by now, largely overcome due to the willing co-operation and unstinted help from various sources.

In this background, the Council of the Institution of Telecommunication Engineers takes pleasure in presenting the Ninth Annual Report of the Institution. During the year under review, it is gratifying to note, the Institution has shown progress in all directions. The Institution has made small but worthwhile contribution in increasing the number of qualified telecommunication engineers, through its system of Graduateship Examination, which is significant at this crucial stage in our Five Year Developmental Plans. The Institution's Journals are aimed at promoting and pooling of engineering and scientific knowledge with a view to developing research and providing experts for the purpose of investigation, planning, design, construction and operation. The Council wishes to express its sincere thanks to the members of the Institution and its office bearers for their whole-hearted effort and co-operation.

The Council, 1961-62

President : Dr. Lal C. Verman

Immediate Past Presidents :

Prof. S. V. C. Aiya

Vice-Presidents : A. C. Ramchandani

C. P. Vasudevan

Col. K. K. Mehta

R. C. Vaish

Brig. B. J. Shahaney

Maj. Gen. A. C. lyappa

B. V. Baliga

Dr. P. K. Kapre

P. M. Agerwala

Brig. T. Barretto Jagdeesh Prasad B. S. Rau N. V. Shenoi Ordinary Members of Council :

Dr. Saroj Datta D. D. Lakhanpal S. Sampath Gr. Capt. T. Srinivasan

> Honorary Treasurer N. V. Gadadhar

Honorary Secretary S. N. Mitra

Honorary Joint Secretaries

K. R. K. Iyengar

Editorial Committee

T. V. Ramamurthi

Lt. Col. J. N. Shahani

Examination Committee

Dr. P. K. Kapre (Chairman)
B. V. Baliga
D. D. Lakhanpal
T. V. Ramamurthi
B. S. Rau
R. Seshasayee
Brig. B. J. Shahaney
S. N. Mitra (Secretary)

Membership Committee

A. C. Ramchandani (Chairman)
N. V. Gadadhar
Jagdeesh Prasad
S. N. Mitra
Gr. Capt. T. Srinivasan
Lt. Col. J. N. Shahani (Secretary)

C. P. Vasudevan (Chairman) Dr. Saroj Datta S. N. Mitra T. V. Ramamurthi S. Sampath Brig. B. J. Shahaney K. R. K. Iyengar (Secretary)

Staff & Finance Committee

Dr. Lal C. Verman (Chairman)
N. V. Gadadhar
Dr P. K. Kapre
A. C. Ramchandani
C. P. Vasudevan
S. N. Mitra (Secretary)

The following members have retired this year from the Council of the Institution under Bye-Law:

1.	Maj. Gen. A. C. lyappa
2.	Col. K. K. Mehta
3.	Shri T. V. Ramamurthi
4.	Shri B. S. Rau
5.	Shri N. V. Shenoi
6.	Shri R. C. Vaish
7.	Shri C. P. Vasudevan

The election to fill up all the vacancies of the retiring Council members was held in accordance with Bye-Laws 39 to 44. The following members have been duly elected to the Council:

- 1. Maj. Gen. R. N. Batra
- 2. Prof. S. P. Chakravarti
- 3. Prof. K. S. Hegde
- 4. Air Commodore K. A. Joseph
- 5. Shri S. K. Kanjilal
- 6. Shri R. Seshasayee
- 7. Shri Uma Shankar

The Council wishes to place on record its deep appreciation of the services rendered by the retiring members and welcomes the new members to the Council.

2. MEMBERSHIP :

The Membership of the Institution is at present of seven categories, viz.,

1.	Honorary Fellows	(HF)
2.	Fellows	(F)
3.	Members	(M)
4.	Associate Members	(AM)
5.	Associates	(A)
6.	Graduates	(G)
7.	Students	(S)

In addition, there is another class of membership known as Sustaining Members. Table I below and Figs. 1 and 2 show the growth of the members of the Institution in various categories, year by year, eversince the Institution came into existence.



It will be seen from the Table I that the membership has shown a steep increase during the current year. The membership stood at 1,976 on 30th September 1961. Today it is 2986. It may be recalled that when the Institution was first set up in 1953, our target was 2,000 members. We are happy to note that within a short space of nine years we have been able to cross this target and has reached a much more promising figure than we anticipated.

 Membership as on	H.F.	F.	М.	A.M.	S.M.	Α.	G.	S.	Total
30-9-1954		-		120		85	360	385	950
30-9-1955	2.	-	19	132	-	72	282	244	751
30-9-1956	3	1	26	186		102	520	446	1284
30-9-1957	4	1	27	195	-	79	489	302	1097
30-9-1958	5	1	31	243	12	63	466	267	1088
30-9-1959	5	1	36	256	13	45	456	238	1050
30-9-1960	5	3	35	273	13	36	484	607	1456
30-9-1961	4	3	39	288	14	36	471	1121	1976
30-9-1962	6	10	39	300	15	35	492	2089.	2986

TABLE I.

This increase in membership has primarily been due to the incentive given by the Government, U. P. S. C. and the various government organisations to those who pass our Graduateship Examination and also by the Defence Ministry for starting telecommunication Tutorial Colleges in several places in India to impart part-time training to the Student members of the Institution. We are thankful to the Government organisations for the incentive given by them as also to the Ministry of Defence for organising these Tutorial Colleges at Bangalore, Bombay, Delhi, Jabalpur and Poona.

Figs. 1 and 2 present a clearer picture of growth of membership over the past years.

Fig. 1 shows the growth in the membership of all categories and Fig. 2 in the category of Students alone. It will be interesting to note that although there is noticeable increase in the growth of total membership, there is a very sharp increase in the category of Student members. We hope that in years to come our membership-increase will be more evenly distributed amongst the different categories of membership. A close scrutiny of the composition of the membership indicates that a large percentage belongs to the public utility services and government undertakings. This is unavoidable since major

organisations in the field of telecommunications in India are in the public sector. However, considering the encouragement given by the Government to private industry for large scale production of radio receivers, radio components and electronic measuring equipment, the growth of membership of the Institution from the private sector is not as striking as may be expected. It is our sincere hope that before long the technicians and engineers working in the private sector will take their due place along with their colleagues from the public sector and help to strengthen the Institution. Only by a co-ordinated and combined effort of all concerned can the Institution render valuable service to the growth of the nation.

The Council wishes to thank the Membership Committee for its arduous task in the selection of various categories of membership during the year.

Every year the Institution is faced with a somewhat unpleasant duty. Quite a few of the members of the Institution fail to pay their membership subscription even after repeated reminders. According to the Byelaws of the Institution, members who do not pay their subscription for two consecutive years cannot remain as members and their names have to be struck off the rolls. This may easily be avoided if the members would kindly instruct their banks to pay their subscriptions within a certain date. We are aware that nobody wishes to be a defaulter intentionally; but paying membership subscription in due time has somehow evaded the attention of some members. This year too the total number of defaulting members whose names are to be taken off the rolls most reluctantly is quite large. We, once again, appeal to all our members to ensure prompt payment and spare us this unpleasant duty. To help members who have forgotten to pay their subscription for two years the Council has decided that such members may be readmitted in the same class to which they belonged by paying the admission fee and the membership fee. We wish to draw the attention of the members to this particular point, who may bring it to the notice of those concerned.

The list of Corporate members and the Graduate members as on 30th September 1962 is given in Part 2 of this Report. Members are requested to kindly intimate to the Secretariat any change in their address or qualifications for necessary correction and completion of our records.

3. JOURNAL OF THE INSTITUTION :

The Institution started publishing in 1955 a journal of its own in order to provide facilities to its members and other engineers and scientists to publish observations and results of their original researches and bring them to the notice of the profession throughout the world. The Journal of the Institution was published a quarterly till 1959. It has been made a bimonthly

from 1960 to accommodate steady influx of articles. We have been able to publish only thirty five research papers during the year under review, while the number of papers received was far in excess of the number published. Some papers had to be returned but several were retained, due to want of space, for publication in future issues.

The Editorial Staff has also started abstracting papers on telecommunication engineering and allied fields published in the Indian Journals and these abstracts will be published from the November 1962 issue of the Journal of the Institution. We are happy to note that the papers published in our journal are being abstracted by all leading abstracting agencies in the world including the U. S. S. R.

The Editorial Committee is happy to announce that contributions from specialists in the fields are forthcoming for publication in the Journal of the Institution. Appeals are sent from time to time to individuals all over the world inviting contributions from their research schools and the response has been good. The Editorial Committee also invites some specialists to contribute review papers on certain subjects where a large amount of research work has already been done including the reviewer himself. Such papers are very useful for reference purposes as they are complete with up-to-date bibliography and also give a connected account of the present-state knowledge of the subject. We hope to publish such review papers more frequently in future issues of the Journal.

In order to create an incentive for publishing good research papers in the Journal of the Institution, an I.T.E. Award has been instituted since 1960. Two such Awards have already been made and an account of the Award is given elsewhere in this report. The Editorial Committee hopes that such an incentive will induce the authors to publish their original research papers in the Journal of the Institution thereby raising its standard.

4. STUDENTS' JOURNAL :

The Students' Journal, a quarterly, started in December 1959, is meant to be of direct use to the Student members of the Institution for supplementing their studies for the Graduateship Examination of the Institution. The papers published so far on different subjects like propagation, antenna, modulation systems, telegraphy, telephony, television system, transmission etc. are strictly within the purview of the syllabus of the Graduateship Examination of the Institution. The Editorial Committee has decided to include a new series on "Industrial Electronics" and hopes that, in time to come, the Students' Journal will cover all the subjects prescribed for the Graduateship Examination and be of invaluable help to the Student members.

The Students' Journal has gained its popularity within a very short time after its publication and many non-student members and organisations giving in-service training have begun to evince keen interest in the Journal. The Council has rightly decided to supply the Students' Journal to non-student members at Rs. 5/-per year. A sum of Rs. 25/- is given to the contributor as honorarium for each paper published in the Students' Journal. Examiners for the Graduateship Examination have been requested to keep in view the articles published in the Students' Journal mapers for the Graduateship Examination. In this way some of the specific needs of the Student members are being met and also they are given the benefit of specialists' help in the understanding of the problems for which adequate literature is not available.

The Council wishes to record its deep appreciation to the Editorial Committee for its sincere work in making the publication of the Institution a success. A list of papers that has been published in the Journal of the Institution and the Students' Journal is given in Appxendix 1.

The production cost of the Journals of the Institution is undoubtedly high and constitutes a sizeable percentage of the expenditure of the Institution. This is partly met by the revenue that accrue from the advertisements published in the Journals. While the Council wishes to express its thanks to the many firms and organisations who have taken up space for advertisement in the Journals, there are many other organisations in the field of telecommunication engineering who could use the Journal as a valuable medium for advertising the equipment and components they manufacture or sell. The Council takes this opportunity to request these firms both in India and abroad to use this Journal for advertisement so that the professional telecommunication engineers in the country, most of whom are our members, become aware of the latest developments in the field of electronic equipment and components.

	TABLE 2.	
Year	Journal of the Instn. of Telecomm. Engrs.	Students' Journal
1955	13	
1956	24	
1957	28	
1958	25	
1959	28	
1960	28	20
1961	31	14
1962	35	14

Table 2 above indicates the number of papers that has been published in

different years in the Journals of the Institutions. It is of interest to note that there is an upward trend in the number of papers published each year.

Due to heavy influx of research papers, a proposal to make the Journal of the Institution a monthly one from April 1963 is under active consideration of the Council.

5. I. T. E. AWARD :

The Council of the Institution decided to award during each calender year one I.T.E. Award worth Rs. 500/- to the best contributor of orginal research paper. The Council took this decision in order to encourage publication of good research papers in the Journal of the Institution. It felt that such an incentive should be created to attract research workers to contribute their best articles to the Journal so that the standard of the Journal may go up and its prestige, as an organ of the Institution, is enhanced in the outside world.

The first award was announced at the Seventh Annual General Meeting for the best contributor of research papers published during the year March 1955 to December 1959. It was decided that contributions made only by the members of the Institution should be considered for this Award. Since this year, in order to give equal opportunity to all research workers publishing their papers in the Journal of the Institution to compete for the Award, the Council decided that the I.T.E. Award should be open to all such contributors, both members and non-members.

Prof. S. V. Chandrasekhar Aiya, President of the Institution during 1959-60 introduced the basic concept of the Award at the Seventh Annual General Meeting held on 23rd December 1960 with the following words: "Our primary national objectives are the production of material wealth and elimination of poverty by the application of science and technology. In this sphere, we have a very heavy responsibility to discharge. Progress requires that someone, somewhere should do or make something that no one has done or made before. Even putting to use unutilised indigenous material falls in this category.

We have to create the climate for original, independent and unconventional thinking so that the few capable of such work and who really matter for the production of wealth come quickly to the forefront. Originality, like measles, is contagious, but like measles, it will only be caught by those susceptible to it. The need of the hour is, therefore, to breed this desirable disease of originality. The one known way of doing this is an atmosphere of research. Research is a driving force and guiding star. Unfortunately, anything seems to be passing off as research and this abuse has made it a

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straw to be clutched at by a drowning man. Research has to be judged not by the amount of paper and ink used in writing voluminous confidential reports or even by the pages of research papers published, but by its quality. If anyone has done something to advance knowledge or made something which no one has made before, he can make even the man in the street understand his results.

It is the duty of a professional Institution like ours to assess research correctly and objectively regardless of the position of an investigator and to bring to light those capable of such good work. We have, therefore, quite rightly instituted a prize to be given to a paper of value published in the Journal. Originality and certainty never go together and the reward, if given, has to be quite significant. We have, therefore, put the value of the prize at Rs. 500/-. It should be still higher but this is the limit to which we could stretch, having regard to our limited finances."

The I. T. E. Award for the best contributor of original research article published during the year 1959-60 was made to Shri Chaman Lal, Deputy Chief Engineer, All India Radio, New Delhi for his paper "Flutter Fading of Short Wave Radio Signals in Equatorial Regions and its Connections with Spread Echoes, Magnetic Storms and the Radiation Belt" which appeared in the August 1960 issue of the Journal of the Institution. We heartily congratulate Shri Chaman Lal for securing the I. T. E. Award for 1961.*

From this year the Institution has started presenting a citation along with the Award to its recipient. The citation was read out by Dr. Lal C. Verman and the Award was presented to him by Shri V. K. Krishna Menon, Minister for Defence, Government of India who was the Chief Guest at the Eighth Annual General Meeting. The citation is given on the next page :

The I. T. E. Award for the best contributor of original research paper was decided by a Prize Award Committee consisting of the following members:

> Dr. Lal C. Verman (Convenor) Prof. S. V. Chandrasekhar Aiya Shri B. V. Baliga Maj. Gen. A. C. Iyappa Prof. S. K. Mitra Prof H. Rakshit

The Council wishes to express its sincere gratitude to the members of the Prize Award Committee for their arduous task in selecting the best contributor of original research paper for the Award.

*The first I. T. E. Award for 1960, to the best contributor to the Journal of the Institution of original research papers published during the years 1955-1959 was presented to Shri S. N. Mitra, Research Engineer, All India Radio, for his paper "Magneto Ionic Triple Splitting over Delhi" which appeared in the September 1959 issue of the Journal of the Institution.

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P. C. Meinen President 198.

6. EIGHTH ANNUAL GENERAL MEETING :

The Institution was honoured during this year by the presence of Shri V. K. Krishna Menon, Minister for Defence, who inaugurated the Annual General Meeting on 12th January 1962. The Annual General Meeting was held on the lawns of the Indian Standards Institution, New Delhi and was attended by a large number of people from various professions. The Council is particularly happy to note that Shri S. V. Ramaswamy, Deputy Minister for Railways, found it convenient to attend the Annual General Meeting.

The Council wishes to place on record its deep appreciation to its members and to other distinguished persons who were present at the Annual General Meeting. Particular mention may be made of Shri V. Nanjappa, Director General of Posts & Telegraphs; Maj. Gen. Harkirat Singh, President of the Institution of Engineers; Lt. Col. N. B. Grant and other distinguished visitors who were kind enough to attend the Annual General Meeting.

Gr. Capt. (now Air Cdre) K. A. Joseph, in his welcome Address to the Chief Guest, gave a little historical background of the development of the Institution. He emphasized in his address that the establishment of a training scheme by the Ministry of Defence for training the Student members of our Institution for the Graduateship Examination has already given impetus to the increase of student membership, particularly from the Defence Services. The need for such part-time training was first recognized by the Minister for Defence and it was through his initiative that the training scheme was organized. It was, therefore, fitting that the Minister for Defence should be the Chief Guest at the function. The Institution had started a Students' Quarterly with a view to helping the Student members in their examination. An event of particular importance and interest to the Institution during the year was its participation in the Indian Parliamentary and Scientific Committee as a member. This Committee is headed by the Prime Minister and many distinguished members of the Parliament and heads of professional organizations are in this Committee.

Gr. Capt. Joseph congratulated the Minister for Defence on the manifold activities of Defence Services in trying to make India self-sufficient in defence equipment. The recent air display of the "Avro 748" was a culminating success of the initiative and planning shown by the Minister for Defence.

Shri V. K. Krishna Menon, Minister for Defence, inaugurated the Eighth Annual General Meeting of the Institution. He congratulated the Institution on the progress it has made during the small span of eight years and was happy to note that the Institution was encouraging collective organization which the country needs very much today.

While reviewing the progress the country has made after Independence both in the technological field and otherwise, he emphasized that although traditionally there is a misconcept that the Indian people do not bother about time, the progress is bound to be slow as the country has to face multifarious problems facing the population of more than 432 millions in every sphere of life.

With the progress of science the pace of technological progress has to become faster. He said, "Technological advance is one of the characteristics of the twentieth century. Although the twentieth century has been called the age of war, the age of pride, the age of nationalism, etc., it is certainly the age of technology. One of the great advances of the twentieth century is the closing of the steel age and the entering into nuclear age." He emphasized the need for a constant development for the discovery of resources and raw materials through technological advances though the country may not be able to meet with immediate success.

Then he stressed that with the advance in technology, the people should also be made technologically minded. Furthermore, the Minister emphasized, "In a professional organization you are not merely concerned with the career of profession which of course should not be forgotten. But with the progress of these standards, with the advancement of knowledge certain codes of behaviour will result. In a scientific field I hope a time will come when this country will be able to make its contribution to the world. In a scientific field I hope that the great scientists will become personally responsible for the results of their actions. Thus, certain codes of behaviour must be established. So the professional organization in that sense has this great importance that it would maintain a standard of the profession." He said, "Your control of quality should depend upon the moral quality of the engineer who says 'I am an Engineer. I will not let this go.' You may as well ask if moral qualities develop they should develop in an individual; but why in an organization? The development of moral and ethical qualities are partly dependent upon our desire to have the esteem of being a fellow-being. In a society of this kind of all professional organizations, large number of people come into contact with each other and each one is anxious to be as good or better than his fellow-being. That is why a professional organization is important in maintaining the standard codes of conduct of the profession."

Then he dealt with an important issue bearing on the need of more engineers of all profession in the country. He added that there would be dearth of engineers soon, in spite of the Planning Commission and the Engineering Colleges turning out more engineering graduates. He felt very happy that a part-time training scheme has been initiated by the Ministry of Defence to train young people in the profession to become professional engineers.

Further, he remarked that practical experience should play a more important role in the curriculum of engineering education. This awareness, he said, is increasingly taking shape with the advance of technology and advance of industrial development. He said, "A time will come when instead of workshop people going to universities, university students will go to workshops."

In his concluding remarks he emphasized that though scientific discoveries are slow, the individuals who have chosen a career for science should have infinite patience and a deep sense of humility before they succeed. It is more the attitude towards work and life than anything else that brings the person to making worthwhile contribution. He concluded, "I hope your organization will inculcate this sense of modesty and humility in each of your members for making it a truly scientific and technical organization. I thank you for inviting me to inaugurate this function and I wish you all success."

Dr. Lal C. Verman in his Presidential Address referred to a fundamental policy matter which the engineers of the country are to-day faced with. The issue was whether each well-recognized branch of the engineering profession such as electrical, chemical, telecommunication, etc., should have a strong institution of its own, or whether one single institution would be capable of dealing with the needs of all branches of the profession. Considering the rapid development of such institutions in more advanced countries and taking into consideration the fast pace of advancement in scientific and technical knowledge in every branch of technology, it appears that several strong independent institutions dealing with well-defined branches of the profession should be encouraged to develop on the lines that they have developed in many other advanced countries. At the same time it will be useful to bring into being a small central body representing all institutions to deal only with matters of common interest to all branches of engineering profession such as, for example, the establishment of professional standards, codes of conduct, etc. Such a proposal already exists before the Ministry of Scientific Research & Cultural Affairs and Dr. Verman hoped that the Cabinet would find an opportunity to consider the issue and give the necessary lead to the engineering profession which it needs today.

The membership of the institution is increasing rather rapidly. It has risen from 950 to the present level of 1976 members. Dr. Verman, however, pointed out that the response from the private industries has not been so satisfactory. He urged such industries to join the Institution and take their due place and help to strengthen the Institution. Dr. Verman then announced the I. T. E. Award. This award was constituted in 1960 for the best contributor of the most original article published in the Journal of the Institution of Telecommunication Engineers and was meant to serve as an incentive to research workers

in the field of electronics and telecommunication engineering. The first award was presented in December 1960 which was won by Shri S. N. Mitra, Research Engineer of All India Radio and Secretary of the Institution. The award for the year 1960-61 was made to Shri Chaman Lal, Deputy Chief Engineer, All India Radio, New Delhi, for his article, "Flutter Fading on Short-Wave Radio Signals in Equatorial Regions and Its Connection with Spread Echoes, Magnetic Storms and the Radiation Belt" that appeared in August 1960 issue of the Journal of the I. T. E. Dr. Verman mentioned that this was the second year in succession that the I. T. E. Award had been won by a research worker in All India Radio and the A. I. R. authorities should feel proud of their research workers having set an example for others working in the field of telecommunication in different private and public institutions.

He referred to the examination conducted by the Institution and pointed out that the percentage of students passing the examinations has been rather low. This was due to lack of facilities for the students to prepare for the examination. Time and again proposals have been made that the Institution, besides conducting examinations, should itself take up the actual coaching of the candidates sitting for these examinations. But professional institutions like ours should hardly do full justice to such training. Dr. Verman felt particularly happy that the Ministry of Defence has started a part-time training scheme at Delhi, Bangalore and Poona for training the students for its Graduateship Examination. It was entirely due to the initiative of the Minister for Defence. The percentage of pass would definitely increase by such training. Local centre activities were also referred to by Dr. Verman. These centres were quite active. The Institution is proud to be called upon to collaborate with official and unofficial bodies such as the Indian Parliamentary and Scientific Committee, the Manpower Steering Committee of the Ministry of Home Affairs and the Indian Standards Institution. Dr. Verman assured the Minister for Defence that the Institution would only be too glad to help anybody or any organization whether in the public or private sector on any problem relating to telecommunication engineering.

In conclusion, Dr. Verman referred to the inadequate facilities regarding the library and building of the Institution. The Institution has already approached the Ministry of Scientific Research and Cultural Affairs for a sizeable grant for the library and building. The Ministry of Works, Housing and Supply has also been approached for a plot of land for housing the Institution. With its library properly augmented, the Institution will be able to serve its members in a much more effective way. He then congratulated Dr. D. S. Kothari on his election as Honorary Fellow of the Institution. By offering this Fellowship to a distinguished scientist of Dr. Kothari's standing, the Institution is not so much doing him an honour as it is being honoured itself by his acceptance.

Shri S. N. Mitra, Honorary Secretary of the Institution offered a vote of thanks to the Chief Guest and the others. He expressed the sincere gratitude and thanks of the Institution in the acceptance by the Minister for Defence the invitation to inaugurate the Annual General Meeting and for his kind and encouraging words. Dr. Verman, as the Director of the Indian Standards Institution, made available the lawns of the Institution, the Conference Hall and the Museum for holding the Annual General Meeting, the Technical Convention and the Exhibition of Electronic Equipments. The Institution is deeply indebted to Dr. Verman and his colleagues of the I.S. I. for this generous gesture. Shri Mitra also thanked Mrs. Verman who had spared no pains in looking after the arrangements of the inaugural function to the minutest detail. The response from the manufacturers to the exhibition of Electronic Institution has been extremely satisfactory and the Institution was grateful to these manufacturers for coming forward to show their products at the exhibition. The Institution was very happy to find so many distinguished visitors who had kindly graced the inaugural function. He thanked Messrs Motwane Private Ltd. for arranging the Public Address system at the inaugural ceremony and the staff of the I.S.I. for taking great pains in making this inaugural function a success. He also expressed the appreciation of the Institution to Messrs Associated Instrument Manufacturers (India) Private Ltd. for arranging a film show at the end of the inaugural ceremony.

After the vote of thanks a technicolour film, By Precision to Perfection, was shown to the audience by courtesy of the Associated Instrument Manufacturers (India) Private Ltd. The film was highly appreciated by the audience present.

7. FIFTH TECHNICAL CONVENTION :

The Institution organized a Technical Convention on 13th and 14th January 1962 where research papers were read and discussed. Invitations were extended to research organizations in Government Departments, Council of Scientific & Industrial Research, industries, universities and public institutions in India to send papers for being presented at the Technical Convention. Invitations were also extended to similar organizations outside India. Response from various organizations has been very generous and thirty-five papers were presented dealing with Ionospheric Propagation; Noise, Atmospheric, Cosmic Galactic and Solar; Components including Tubes and Solid State Devices—their standards, specifications and tropicalization problems; Microwave Circuits and Components; Industrial Electronics; Systems Engineering; Computer Techniques; Television; Transistor Technology; and Sound Engineering. A list of papers presented at the Convention is shown in Appendix 2.

During this year the symposium was organized in a somewhat different manner. Papers were grouped subject-wise and four sessions were planned. This provided opportunity of group discussion on specialized subjects.

First Session

The first session contained ten papers on Ionospheric Propagation, Radio Noise, Components including Solid State Devices-their standards, specification and tropicalization. Shri A. C. Ramchandani, Chief Engineer, All India Radio, New Delhi, presided over the session. The session lasted from 10.00 a.m. to 1.00 p.m. on 13th January 1962. Shri Ramchandani welcomed the participants and expressed his appreciation at the large number of papers being presented on many different subjects in the Technical Convention. During the session, the Research Department of All India Radio presented a series of papers on ionospheric investigations conducted by its members. Five papers including analysis of some of the I. G. Y. data collected by the Research Department of All India Radio were presented. K. C. Chadha presented a comparison between three different methods of calculating skywave field intensity, namely the CRPL, the SPIM and the RPU-9 methods. Field strength figures recorded for 51 years at Nagpur by the A. I. R. were analysed and observed values compared with results obtained. It was concluded by him that none of the methods can merit acceptance in its present form and probable causes for drawbacks of specific nature were pointed out. Ionospheric observations taken at Madras by All India Radio during I. G. Y. were analysed and results were presented in two papers : one, "Ionospheric Observations at Madras during I. G. Y." by S. Rangaswamy and Miss S. C. Krishnan and the other, "Variation of Midday Critical Frequencies with Lunar Age at Madras" by S. Rangaswamy. One important conclusion of the observation at Madras was that the occurrence of Sporadic E was significantly lower than that observed at equatorial stations like Huancayo, Tiruchirapalli and Trivandrum. In a paper "Total Electron Content of the F2 Layer at Madras during 1959", C. S. R. Rao and Mangal Sain showed that when the total electron content is considered, its variation was smoother than that of maximum electron density for both quiet and disturbed days. The analysis also indicated that the 'bite-out' effect observed in the diurnal variation of electron density gets removed in the total electron content and day-time values of electron density and total electron content are generally higher on disturbed days than on quiet ones. The temperature for different seasons was also calculated from the values of scale height. Drift observations taken by the Research Department of A. I. R. during the I. G. Y. were presented by S. N. Mitra and M. Krishna. The specific investigation reported relates to the location of the drift system in the ionosphere. From observations conducted at two

nearby frequencies which gave variations in heights of reflection by 10 km., it was concluded that the location of the drift system was at the point of reflection. Y. S. N. Murthy of the Research & Development Organization, Ministry of Defence presented a paper on the "Validity of an Approximation to the Magneto-ionic Formulae". It was concluded that the approximation suggested was valid for Pennsylvania State for vertical sounding studies in the E-region. B. S. Nargas and V. D. Pethe of the Wireless Planning & Coordination presented a paper on the importance of measurement of S values in wireless monitoring. The investigation presented in this paper was of great operational importance since it tried to establish a correlation between field strength and S value of SSA scale, SINPO and SINPFEMO codes. Such correlation could be used when the receiver was used under certain defined conditions. M. K. Basu and K. R. Phadke of the same organization presented a paper on the measurement of atmospheric noise. These measurements were carried out at the International Monitoring Station, Delhi, with the help of an NBS Noise Recorder. The analysis of the data indicated that the CCIR Report No. 65 might need suitable revision. S. S. Mani of Civil Aviation Department presented two papers : one on "Prediction of Reliability of Ground Electronic Equipment" and the other on "Vacuum Tube Applications---Its Importance in Reliability of Electronic Equipment". The Chairman then wound up the session and thanked the speakers.

Second Session

The second session was devoted to Microwave Circuits and Components and was held on 13th January 1962 from 2.00 p.m. to 5.00 p.m. The Chairman of the session was Dr. Amarjit Singh, Deputy Director, Central Electronics Engineering Research Institute, Pilani. In this session seven papers were presented of which two were from the Research & Development Organization of the Ministry of Defence, four from the National Physical Laboratory and one from the Institute of Physics, Polish Academy of Sciences, Warsaw, Poland. J. K. Sinha (R. & D. Organization) presented a paper on "Modified Cavity Resonator Method of Measuring Dielectric Constants." He described an improved method of measuring dielectric constant of a variety of dielectrics using matched sample method. In the next paper by J. K. Sinha and S. Sundaram a technique for "Measuring of High Values of 'Q' of Microwave" Cavities" was described. S. J. Lewandowski of the Institute of Physics, Polish Academy of Sciences, presented a paper on "Some Design Problems of a Star Type Ferrite Circulator." He described in detail the X-band, low power ferrite circulator whose main operational feature is bandwidth of approximately 7 per cent. Main parameters of the circulator are : frequency band 9000-9600 Mc/s., minimum reverse loss 25 db., maximum forward loss 0.5 db.

L. Torstensson, N. C. Vaidya, K. Chandra, S. Ram Gopal and R. C. Vatsa of National Physical Laboratory presented a paper on the development of Reflex Klystrons which was fabricated at the National Physical Laboratory. R. Parshad and S. Roy Choudhury described methods of accurately measuring standing wave ratio at microwave frequencies. P. Malhotra and R. Parshad of the National Physical Laboratory presented a paper on the generation of special and arbitrary waveforms using binary counters. In the last paper of the afternoon session, R. Parshad and T. Singh described some methods for generation of linear sweep voltages. The Chairman wound up the session and thanked the speakers.

Third Session

The third session of the symposium was held on 14th January 1962 when papers on Industrial Electronics, Systems Engineering, Computer Techniques, Television, etc., were read. The Chairman of the session was Shri C. P. Vasudevan, Director, Telecommunication Research Centre, P. & T. Directorate, New Delhi. In the first paper of the session, S. Sampath and K. Venkataramanan of the Department of Electrical Communication Engineering, Indian Institute of Science, Bangalore, presented an interesting paper on "Evaluation of Amplification Factors in Multi-Grid Tubes by an Electrolytic Tank Method". In this method the authors had tried to overcome the difficulty involved in simultaneous adjustment of the various electrode potentials in the proportion required to produce the current cut-off condition in the tank. This difficulty may be overcome by a technique of grounding the electrodes selectively. The study showed how with tube models that could easily be set up, by simple electrical measurements, an important parameter of complex tube forms may be directly determined. N. Seshagiri of Indian Institute of Science, Bangalore, presented a paper on the "Space-Charge-Limited Current Flow from a Circular Cathode to an Elliptic Anode". D. V. R. Vithal of the College of Engineering, Osmania University, Hyderabad, presented a review paper on "Adaptive Systems." In the next paper, K. K. Bose of the Indian Institute of Technology, Kharagpur described "Control Characteristics of 4-Layer Silicon Controlled Rectifier". Y. N. Bapat of Electrical Engineering Department, Indian Institute of Technology, Bombay, read his paper on "High Speed Computer Switching Circuits" in which the growth of using modern high speed computers and semiconductor devices was first described and then inherent speed limitations of these devices were discussed. L. K. Wadhwa of the Research and Development Organization, Delhi, next presented a paper on "One Operational Amplifier Simulates Third Order Systems with Simple-Lead." K. Venkataramanan of Birla Engineering College, Pilani, presented a paper on "Synthesis of Control Grid Structure for Remote Cut-off Tubes from the Transfer Characteristic."

G. G. Vaswani of the Research Department, All India Radio, then read his paper on "Film Recording in Television". Ryszard Nowicki of Warsaw Television Plant, Warsaw, submitted a paper on the Polish Television Receiver 'Koral'. The 'Koral' can be produced in two versions, i. e. according to the Western European CCIR standard, or the Eastern European OIRT standard. The main features of the television receiver are: picture size of 29×36 cm., sensitivity, well below 100 μ V., very good selectivity, 12-position channel selector for reception in the I and III television frequency bands and small picture distortions which are below 6 per cent. The Chirman then wound up the session and thanked the speakers for their contribution.

Fourth Session :

The fourth and the last session of the Technical Convention was held on 14th January 1962 between 2.00 p.m. and 5.00 p.m. in which papers on Transistor Technology and Sound Engineering were presented. The Chirman for the session was Dr. N. B. Bhatt, Deputy Chief Scientific Officer, Defence Science Laboratory, Delhi. In this session, nine papers were presented of which a large number came from the National Physical Laboratory. In the first paper of the session J. C. Shouri, Research & Development Organization, Ministry of Defence, Delhi, described his investigation on "Harmonic Distortion in Transistor Amplifiers". M. V. Joshi and his colleagues presented four papers on research investigations carried out by them on transistor technology at the National Physical Laboratory. The first paper was by M. V. Joshi on the "Transistor Mixer," the second paper by M. V. Joshi and P. K. Rangole on "Laplace Transforms for Transistors," the third paper by S. Basavaiah on the "Frequency Modulation of Transistor Oscillators" and the fourth by M. A. Narayanan on "Transistors in Switching Circuits." The papers covered a wide field from involved mathematics to practical circuitry in the transistor technology. Rajendra B. Edwards of Telecommunication Training Centre, Jabalpur, presented a paper on "Reducing Cubic Distortion of Speech Signals due to Voltage Limiting." A new method of linearization was suggested by the author permitting limitations of the dynamic volume range transmitted yet decreasing the distortion. K. D. Pavate, J. D. Jain and M. R. Kapoor of the Central Electronics Engineering Research Institute, Pilani, presented a paper on "Acoustical Environment for Calibration of Microphone". K. C. Chadha of Research Department, All India Radio, in the concluding paper of the session, presented his investigations on efficiencies of loudspeakers and a simple graphical procedure for the calculation. He mentioned that frequency efficiency characteristic of a loudspeaker is of greater practical significance than the frequency response characteristics measured in the conventional manner along the axis. He described three methods currently used for the measurement of

frequency response characteristics of a loud-speaker and pointed out limitations in each of the methods. He then described the graphical procedure for calculating the efficiency in a very simple manner.

The Chairman wound up the session. In his concluding remarks, he mentioned that electronics is coming to use more and in almost every field of engineering. The subject of electronics has indicated a revolutionary expansion during the last decade or two, and it can be predicted with certainty that electronics is going to occupy a very important role in the future development of all communication services.

The Technical Convention was attended by universities and other research Participants included research workers from the Research organizations. Department of All India Radio, New Delhi; Defence Research & Development Organization, Delhi; Wireless Planning and Co-ordination, New Delhi; Civil Aviation Department, New Delhi; Institute Physics, Polish Academy of Science Warsaw; Indian Institute of Science, Bangalore; National Physical Laboratory, New Delhi; College of Engineering, Osmania University, Hyderabad; Indian Institute of Technology, Kharagpur; Indian Institute of Technology, Bombay; Defence Science Laboratory, Delhi; Birla Engineering College, Pilani; Warsaw Television Plant, Warsaw; Telecommunication Training Centre, Jabalpur; and Central Electronics Engineering Research Institute, Pilani. Abstracts of thirty-five papers which were read and discussed were presented in the form of a booklet and supplied to all members and participants. Each session was attended by about hundred people and there were lively discussions after the presentation of each paper. The Institution is considering publication of these papers in its Journal. The papers will be grouped and special issues will be brought out on specific subjects. The Institution takes this opportunity of expressing its gratitude and thanks to all the participants to the Technical Convention and making it a great success.

A noteworthy feature of the Technical Convention was the exhibition of a technicolour film on the manufacture of submarine cables by Messrs Standard Telephones and Cables Co. Ltd., on the first day of the Convention. The Institution is grateful to Mr. Annable of S.T.C. for arranging the film show.

Originally, the Technical Convention was supposed to be held in the middle of December 1961. At the same time a U.R.S.I. Symposium on A.G.I. results was being held at Nice, France. The participation from organizations outside India was therefore difficult. However, the Institution has received encouraging response from such organizations and scientists abroad and it is hoped that in future the Technical Convention of the Institution will be arranged in such a manner that contributors from abroad do not find any difficulty in participating at the Convention.

8. EXHIBITION OF ELECTRONIC EQUIPMENT :

The Exhibition of Electronic Equipment which was organised in the Museum Hall of the Indian Standards Institution was inaugurated by the Defence Minister Shri V. K. Krishna Menon after the inaugural ceremony of the Annual General Meeting was over. The Defence Minister went round the various stalls and showed keen interest in the various equipment and components exhibited at the exhibition. The exhibition was open to the members as well as to the public on 13th and 14th January 1962 from 10.00 a. m. to 5.00 p. m. Participants to the Convention as well as interested persons from outside visited the various stalls. The following organisations took part in the exhibition.

- I. The Aluminium Industries Limited.
- 2. Associated Instruments Manufacturers (India) Private Ltd.
- 3. Eastern Electronics.
- 4. Hindustan Cables Limited.
- 5. Indian Telephone Industries Ltd.
- 6. Motwane Private Limited.
- 7. Toshniwal Bros. (Private) Ltd.
- 8. General Electronics, Ambala.

The Council wishes to thank these organisations for having come forward to show their products at the Annual General Meeting of the Institution.

9. EXAMINATIONS :

The Graduateship Examination of the Institution has become very popular after its recognition by the Ministry of Scientific Research and Cultural Affairs. It used to be held once a year starting from 1955 but due to increasing demand it is' held twice a year since 1960. The examinations are held at eight centres in India, viz. Bangalore, Bombay, Calcutta, Delhi, Ernakulam, Jabalpur, Madras and Poona. The examination had a very modest beginning in 1956 when only 22 candidates appeared. Increasing popularity is reflected in 376 candidates applying for the November 1961 examination and 600 in May 1962 examination of the Institution. 1177 candidates will be taking the examination in November 1962. Table 3 below gives the number of candidates applied for the Graduateship examination of the Institution ever-since the examination was instituted. It will be noted from this table that there has been a rapid increase in the number of candidates from 1959 onwards.

This is largely due to the recognition given to the examination both by the Ministry of S. R. & C. A. and the U. P. S. C., as being equivalent to a degree in telecommunication engineering and such persons who successfully complete the Graduateship Examination can be considered for appointment to posts in superior engineering services.

Year	No. o May	f Candidates November	Total
1956	22		22
1957	26	_	26
1958	- 47	-	47
1959	58		58
1960	190	236	426
1961	299	. 376	675
1962	600	1177	1777

TABLE 3.

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During the year the examinations were held in November 1961 and May 1962 in which 976 candidates appeared. The total number of candidates that successfully completed the examination was 74, percentage of pass being 7.67. Out of the 976 who appeared for the last examination 465 have passed in parts. The following is the list of candidates who have successfully completed the examination in November 1961 and May 1962.

November-1961

1.	S. K. Banerjee	19.	S. Rajendran
2.	R. Alexander	20.	H. N. Khare
3.	J. C. Malhotra	21.	V. B. Bhalla
4.	A. Ranga Vittal	22.	Din Dayal
5.	B. Vasanth	23.	P. C. Nair
6.	G. S. Jain	24.	K. C. Chopra
7.	D. B. N. Murthy	25.	Rajendra Nath Pasrij
8.	C. Karunakaran	26.	J. P. Kalra
9.	S. Jambu	27.	T. R. Venkataraman
10.	H. S. Virdi	28.	R. P. Agarwal
11.	S. C. Mittal	29.	Sangam Viswanathan
12.	S. P. Jain	30.	Baldev Raj Sachdeva
13.	R. S. L. Srivastava	31.	U. C. Jain
14.	P. S. Sethi	32.	R. Nagarajan
15.	K. K. Bhakthisaran	33.	H. S. Narual
16.	N. Anantharaman	34.	K. Subramaniam
17.	S. N. Misra	35.	K. V. V. Krishnaiah
18.	M. Y. Bhat	36.	V. Sowmiyanarayanan
	37. S. N. Sivaramal	rishna	n

May-1962

1.	Ishwar Dutt	19. Vishnu Daya Srivastava	19.	
2.	Harphul Singh	20. S. V. Chabukeswar	20.	
3.	K. K. Malhotra	21. S. G. Mutalik	21.	
4.	M. Venkateswaran	22. R. Venugopal	22.	
5.	V. N. Chakravarti	23. S. P. Mittal	23.	
6.	Surinder Singh	24. S. K. Ghambir	24.	
7.	M. N. Kashyap	25. Chaman Lal Chikersal	25.	
8.	S. K. Mallik	26. A. K. Shintre	26.	
9.	M. K. Bakshy	27. K. K. Basu	27.	
10.	M. L. Suri	28. A. Sivasankara Pillai	28.	
11.	P. R. Sowmya Narayanan	29. L. S. Varadarajan	29.	
12.	C. B. Srivastava	30. S. Parthasarathy	30.	
13.	R. C. Luthra	31. Mohan Lal Gupta	31.	
14.	K. M. Unni	32. K. C. Bagh	32.	
15.	Har Maya	33. V. B. Srivastava	33.	
16.	Brij Bhushan Sharma	34. D. D. Gadre	34.	
17.	M. G. Bhat	35. Pratap Narayan Dixit	35.	
18.	O. P. Sehgal	36. T. V. Prasada Rao	36.	

37. R. N. Chaukar

The result of the examinations, however, has not been very encouraging in that only a small percentage of candidates is able to get through. It has been so in all the previous examinations. Table 4 shows the percentage of passes year by year.

Year	Percentage	of Passes November
and the second second	, international statements and statement	
1956	4.5	
1957	0	
1958	2.2	
1959	5.1	
1960	4.4	5.1
1961	7.33	10.1
1962	6.41	

TABLE 4.

It will be noticed that hardly 6 per cent of candidates pass the Graduateship examination. This is, perhaps, inevitable as the students who appear for the examination have not in the first place been selected for their aptitude, nor do they have adequate opportunity of regular coaching, nor of attending any evening classes for preparing for the examination. Whatever success has been achieved has been due to personal efforts and initiative of the candidates themselves.

In order to encourage such students who wish to appear for the Graduateship examination, the Ministry of Defence has launched a scheme of imparting part-time training to the students during the evening periods. Details of such tutorial colleges now functioning under the Ministry of Defence and being financed by the Ministry of S. R. & C. A. and operating at Bangalore, Bombay, Delhi, Jabalpur and Poona have been given elsewhere in this report (see page 28). It is hoped that with this encouragement given by the Ministry of Defence a larger number of candidates will be able to get through our examinations and thereby contribute more effectively to the national pool of engineers so vitally needed for the implementation of the developmental plans.

There have been some comments on the standards of the I. T. E. Examination which are apparently very high. The Examinations Committee considered this problem in detail and decided rightly that the standard of the institution should not be brought down as it will be detrimental to the profession. The committee, however, felt that the syllabus for the Graduateship examination could be reviewed periodically in order to bring in line with recent developments in the various fields and the employment needs of the day. A Sub-Committee has been constituted comprising of the following members to scrutinise the syllabus and review it, keeping in view the requisite standards of the Graduateship Examination.

> Shri T. V. Ramamurthi Shri K. R. K. Iyengar Shri S. N. Mitra Shri R. Seshasayee.

It is hoped that the Sub-Committee will complete its deliberations within a short time and the revised syllabus together with the text-books suggested will be circulated to all the local centres and given due publicity.

Non-availability of many books and the high cost of available text-books have been a serious problem with Student members of the Institution for preparing for their examination. The Institution requested the Ministry of S. R. & C. A. for a liberal grant, details of which have been reported elsewhere. It is hoped that when the full-fledged library consisting of all the text-books needed for the examination starts functioning at Delhi as well

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as at all local centres, the student members will benefit considerably and the percentage of pass will also increase.

According to Regulation 5 of the Examination Regulations, candidates wishing to appear for Section B of the Graduateship Examination should have either five years' experience in a technical capacity or should produce an eligibility certificate from one of the referees (appointed by the Council) that he has prosecuted and engaged himself in the engineering profession for an aggregate period of twenty-four months. Accordingly, a system of refereeship has been introduced for the benefit of those candidates who do not possess an experience of five years in the field of telecommunication engineering for appearing in Section B Examination. The list of referees is given in Appendix III.

The Council in its deliberations during the year has decided to give the following concessions to the Students appearing for the Graduateship examination:

 In accordance with Examination Regulation 12, a candidate will be declared to have passed the examination when he has passed in all the subjects of the examination. Since a candidate can take up the examination in parts in accordance with Examination Regulation 11, he will in case of failure in two subjects be permitted to complete the part by appearing at subsequent examination.

There were a few cases where the candidates have obtained very high marks in one subject but failed in other papers. In accordance with the existing rule (above para) the candidate has to take up all the papers of the examination again. The Council, therefore, decided that if a candidate gets 65 per cent or above in one subject, he will be exempted from taking the subject in future examinations.

The following amendment to the Examination Regulation 12 para 1 was made as under:

"Exemption from future examination on a subject will be granted if a candidate obtains at least 65 per cent in the same paper at any examination."

- 2. If a candidate after completion of the Graduateship Examination wishes to appear again in one or more of the subjects of Section B for the sake of learning that subject or any use whatsoever in his profession, the Council will permit him to appear in those subjects and a suitable certificate will be issued to him if the passes.
- 3. The Council also decided to exempt those students who have passed their M. A or M. Sc. in Mathematics from appearing at the mathematics paper of Section A.

Frequent requests are received from the Institutions to exempt certain candidates from appearing from one or the other subjects by virtue of their having acquired some qualifications at some technological institutions or universities. Such educational institutions are rapidly growing in India and

the Examinations Committee is seized with the problem of deciding what exemptions could be given for what qualifications.

The Council takes this opportunity of thanking the Examinations Committee for conducting the examinations, appointing the examiners, moderation of question papers and declaring the results of the two examinations. The Council also wishes to express its thanks to the Chairman and the Honorary Secretary of the various local centres in conducting the examinations at their respective centres in the best possible manner.

10. TRAINING SCHEME OF THE MINISTRY OF DEFENCE :

In the last year's annual report the training scheme of the Ministry of Defence for part-time course on telecommunication engineering for the Graduateship Examination of the Institution was announced. For the benefit of the members of the Institution we reproduce below the relevant advertisement issued by the Ministry of Defence for enrolement in the training scheme.

Ministry of Defence

Research and Development Organisation :

Part-Time Courses for Telecommunication Engineering

Applications are invited for enrolment to part-time evening classes to be organised in Defence Establishments at New Delbi, Bangalore and Poona to train a limited number of students for taking Section A and B of the Graduateship Examination of the Institution of Telecommunication Engineers.

Eligibility: Those already elected for attachment to the Institution as Student members. Those who are otherwise eligible for election in accordance with Bye-law 15 of the Institution may also apply but the onus of getting themselves elected will rest with them. The latter, however, will not be allowed to proceed with the course if they do not get themselves elected within three months of its commencement.

Duration of the Course: Commencing from the 11th December 1961, the period of training will be about 160 and 50 weeks respectively for Sections A and B. Classes will run concurrently.

Tution Fee : Rs. 100.00 for each Section A and B.

Application giving the following information should reach the officers shown below against each station latest by the 15th November 1961. (a) Name; (b) Full address; (c) Age; (d) Educational qualifications; (e) Previous engineering experience, if any; (f) Present employment with names of employers; (g) If already elected for attachment to the Institution of Telecommunication Engineers as Student members, and if so the Registration No.; (h) Whether desirous to join Section A or whether he has already passed Section A and would like to join Section B and the groups which he would like to select.

New Delhi: Telecommunication Tutorial College, C/o Signals Directorate, Army HQ., DHQ, P.O.: Bangalore: Telecommunication Tutorial College, C/o Inspectorate of Electronic Equipment, Post Box No. 1506, Hebbal: *Poona*: Engineering Tutorial College, C/o Institute of Armament Studies.

No application will be entertained after the closing date.

The training scheme is now in operation at five place viz. Bangalore, Bombay, Jabalpur, New Delhi and Poona. At Delhi, the Tutorial College was inaugurated by the Defence Minister on 18th February 1962. The inaugural ceremony is briefly reported below:

Telecommunication Engineering Tutorial College, New Delhi.

A Telecommunication Engineering Tutorial College, under the scheme of training engineers in Defence Establishments, has been opened in Army Headquarters Signal Regiment, Red Cross Road, New Delhi. The College was opened by Maj. Gen. R. N. Batra, Director of Signals and Signal Officer-in-Chief, Army Head-quarters, on 2nd. January 1962.

Lt. Col. K. S. Garewal, Senior Officer-in-Charge of the Delhi Centre, welcoming Gen. Batra gave the scope of the College in broad outline and said that it would conduct part-time courses consisting of lectures and tutorial classes in various subjects prescribed for Sections A and B of the Graduateship Examination of the Institution of Telecommunication Engineers. To start with, the College has a capacity of 120 students for Section A only.

Gen. Batra in his opening address remarked that this scheme of training engineers has been started on the initiative of the Minister for Defence. The aim is to train engineers to meet the country's growing demands of technical personnel for our Five Year Plans. The scheme for training of students for the Graduateship Examination of the Institution of Engineers is already in operation at various centres in India. As regards the scheme of training of telecommunication engineers, two other centres at Bangalore and Poona are also being opened. He advised the students to work hard and derive full benefit from the course.

The College was inaugurated by Shri V. K. Krishna Menon, Minister for Defence, at 1730 hrs. on 18 February 1962. The welcome address was delivered by Major Gen. R. N. Batra followed by the addresses by (a) Prof. M. S. Thacker, Secretary and Educational Adviser (Tech.), Ministry of Scientific Research & Cultural Affairs; (b) Prof. D. S. Kothari, Chairman, University Grants Commission; (c) Shri V. Nanjappa, Director General, Posts & Telegraphs; and (d) Dr. Lal C. Verman, President of the Institution of Telecommunication Engineers, delivered the closing address.

Shri V. K. Krishna Menon in his inaugural address said that defence requirements of technological personnel had changed in character during the last three years and welcomed the measures being taken to meet them. As the growing demand for technically qualified personnel could not be met from

the Council for Scientific Research pool and other sources, these measures had to be taken to meet the demands. And one of them is to provide part-time education facilities to people already employed. The Minister for Defence welcomed the formation of the College and said that the institution was unique inasmuch as it provided facilities to people in employment who could not otherwise have had the opportunity of obtaining advanced training. It enabled the talent and capacity of under-employed personnel to be used to meet the needs of the country. He also appreciated the entry of a woman student in the Institution at Bangalore and expressed the hope that more women would take to technical work.

Earlier welcoming the Minister for Defence, Maj. Gen. R. N. Batra gave an account of the College and the handicap from which the students of this College suffer as compared to the students of the regular colleges. He appealed to the heads of the departments to which the students of the College belong to bear in mind that if due to the exigencies of service, the posting of an employee who is a student of this College is unavoidable, as far as possible it should be to another station where facilities for such classes have been provided. He requested them to adjust the shift duties of the employees in such a way as to enable them to attend the evening classes four times a week, that is, Monday, Tuesday, Thursday and Friday. He also stressed that to make an apprenticeship or a part-time scheme a success, the active support and encouragement of the employee to the 'employee student' of his department is of paramount importance.

The progress made by the Tutorial Colleges at Bangalore, Jabalpur, New Delhi and Poona in imparting part-time training to the student members of the Institution is reported below :

Bangalore.

Telecommunication Tutorial College was started in December 1961 under the aegis of the Defence Technical Training Association. The College is under the administrative and technical control of the Chief Inspectorate of Electronic Equipment. It is at present imparting training at degree and diploma levels. In the degree wing, the college prepares students for the Graduateship Examination of the Institution of Telecommunication Engineers.

The first batch, consisting of 138 students, was admitted in December 1961. Regular classes are in progress for Parts I and II of Section A. The first batch of students for Section A Part I will appear for the examination in, May 1963. The second batch, consisting of 75 students, was admitted in August, 1962.

Eligibility: Student members of the Institution of Telecommunication Engineers or other individuals who fulfill the requirements of student membership of the Institution are eligible for admission to the college.

Fees: Tution fees for the complete course preparing for Section A and B of the Graduateship Examination is Rs. 200/-, the amount for each section being Rs. 100/- only. The other fees which are payable in addition to the tuition fees are library fees, laboratory charges and security deposit (refundable).

Duration of Instructions: The duration of the course for Section A and B is as given below:

Section A $2\frac{1}{2}$ years Section B 1 year

Hours of Instructions : The classes are held four times a week from 6 p.m. to 9 p.m. each day.

Educational Visits : Educational visits are arranged to places of electronic engineering interest such as Educational Institutions and Industries in Bangalore. Some such expenses are shared by the students.

Laboratory Facilities : Limited Laboratory facilities are available for the Degree classes.

General: Full information regarding the college is available in the prospectus which can be had on payment of Re. 1/- only from the Administrative Officer of the college.

All queries regarding the college should be addressed to the Registrar, Telecommunication Tutorial College, 62, Jayamahal Road, Bangalore 6.

Jabalpur.

The Telecommunication Tutorial College at Signal Training Centre, Jabalpur commenced functioning on 16th July, 1962. Under the Defence Ministry's Scheme for training Engineers, this College is coaching students for the Graduateship Examination of the Institution of Telecommunication Engineers. At present, there are 21 students on the rolls, the majority of whom belong to Defence Establishments. The classes are held in the evenings. Five of the students are already student members of the Institution. The rest have applied for student memberships.

Lt. Col. M. B. Hart is the Senior Officer-in-Charge of the College. The lectures are being conducted by a team of Officers selected from local defence establishments.

New Delhi.

Introduction : Since the inauguration of the College on 18th February 1962 by the Defence Minister, inquiries regarding the scope and prospects of the scheme have ever been on the increase. A number of candidates applied for admission to the College. However, the College being full to its capacity, could not take on any more students. They had to be content with being placed on the waiting list for the new class whenever it starts.

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New Class: There is a proposal to start a new class in the near future. It is expected that in March 1963, the college may be able to take on students for a fresh class. It is certain that a large number of candidates are looking forward to this opportunity to convert themselves into telecommunication engineers.

Students : At present the College has 127 students on its rolls. The representation of students is varied and covers almost every department which uses telecommunication equipment.

College Staff : Lt. Col. K. S. Garewal is the Senior Officer in-charge of the College. The other 'permanent' staff of the College consists of :

(a)	Lt. Col.	C. U. K. Nair	Senior Instructor
(b)	Major I.	Jayakaran	Senior Instructor
(c)	Capt. S.	S. Bains	Administrative Officer

Most of the part-time instructors come from Defence Establishments.

Attendance: Inspite of the distances involved and time taken to travel by the modes of transport available to the students, the attendance of the classes has been very encouraging. One of the students daily comes from Shahdar to attend his classes at the college.

General Progress of Students : In view of the difficulties involved in such type of coaching schemes where students are of heterogeneous education standards and age groups, special care has to be exercised to check assimilation, so that, as far as possible each individual student benefits to the maximum possible from the scheme. For the benefit of the weaker students extra classes were held in the case of difficult subjects. Students are given progress test every now and then. Based on the results of these tests and class performance, it is intended to send progress reports to the heads of the departments which the students come from.

Four students of the college appeared in the last examination of Grad. I. T. E. held in May 1962. Their results are as under :

32	I. T. E., NEW DELHI, INDIA			
S. No.	Name of the Student	Subjects Passed		
1.	Shri A. L. Budhraja	Engineering Materials & Construction.		
2.	Shri D. Venkataraman	Applied Mechanics and Engineering Materials & Construction		
3.	Shri G. D. Apte	Applied Mechanics and Engineering Materials & Construction		

A number of students are taking the next examination of Grad. I. T. E. in November 1962.

Poona.

The first batch of students from this college commenced their training on 2nd January 1962. The course was formally inaugurated on 9th February 1962 by the Honourable Defence Minister. The classes are being conducted in the Air Force Station (near Yerwada Post Office).

At the commencement of the course there were eighty students. At present forty students are regularly attending the classes. The course is held in Yerwada which is far from town. Hence to provide this facilities to personnel living in the town a second batch of students have commenced training on 16th July at the premises of Shri Cusrow Wadia Institute of Electrical Technology, Poona. Sixty five students are attending this course regularly. The present batch of students are being coached for Section A Examination. On completion of Section A, coaching for Section B will be taken up.

The Institution owes the Ministry of Defence a debt of gratitude for launching the scheme and for its successful operation during the year under review. We hope that with the execution of this scheme the urgent need of increasing number of trained engineers in India, for the successful implementation of the developmental plans will, at least, be partially ful-filled. Furthermore, these telecommunication tutorial colleges have offered incentive to many student members of the Institution to try for better prospects in life. They may now look forward with confidence by undertaking this training to help themselves in addition to helping the nation.

We earnestly hope that in time to come a larger number of similar tutorial colleges will be opened in many other parts of India to help the Student members of this Institution.
11. HONORARY FELLOWS :

Honorary Fellows are distinguished persons in their own fields and it is fitting honour to the Institution like ours that eminent persons in the field should associate themselves with the Institution.

At its 65th Council Meeting held on 18th December 1961, the Council decided to elect Sir Edward Appleton and Dr. D. S. Kothari as Honorary Fellows. Letters requesting them to kindly accept the Honorary Fellowship were duly addressed to them by the Honorary Secretary. We are extremely happy to note that not only did Sir Appleton and Dr. Kothari accept the Fellowship but also sent to the Council very heartening words of encouragement. The brief life histories of Sir Edward Appleton and Dr. D. S. Kothari are given below with their letters of acceptance.



THE OLD COLLEGE SOUTH BRIDGE EDINBURGH 8 GRAMS : UNIGRANTS

UNIVERSITY GRANTS COMMISSION RAFI MARG, NEW DELHI- (30th December, 61.

12th January, 1962.

Dr. S. N. Mitra, Honorary Secretary, The Institution of Telecommunication

The Institution of Telecommunication Engineers, Post Box No. 481, New Delbi, India.

My dear Dr. Mitra,

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IN INWARD APPLETO

I feel deeply honoured by the invitation to become an Econorary Fellow of your Institution and accept it with very warm satisfaction. I realise that the Institution is a mulatively youthful organisation, but I have already seen what a substantial contribution it has made to the adventement of our subject. In saying, then, how proud I am to belong to it in this delightful way I send its governing body my best wishes for continued success in the future.

Yours very sincerely,

200 M. Caplain

Dear Dr. Mitra,

CHAIRMAN

Many thanks for your letter of 29th Desember inviting me to become an Monorary Fellow of the Institution of Telecommunication Engineers. I sincerely appreciate the honour, and would request you to convey my thanks to the Council of the Institution.

With kind regards,

Yours sincerely, D. S. (AC (D.S. Kothari)

Dr. S.N. Mitra, Research Enginser, All-India Radio, Akashvani Ebavan, Parliament Street, <u>New Delhi</u>,

Life Sketches of Honorary Fellows :

SIR EDWARD APPLETON

Sir Edward Appleton, G.B.E., K.C.B., F.R.S., who in 1947 was awarded Nobel Prize for Physics, is eminent both as scientific investigator and adiministrator, and particularly as a pioneer research worker into the propagation of electromagnetic waves. He retired from the Secretary-ship of the Department of Scientific and Industrial Research in 1942 to return to the academic field, as Principal and Vice-Chancellor of Edinburgh University.



SIR EDWARD APPLETON

It was towards the end of the year 1924 that Dr. Appleton, as he then was, began a series of experiments which proved the existence of that layer in the upper atmosphere now called the ionosphere. With the cooperation of the British Broadcasting Corporation, the Bournemouth transmitter was made to shoot radio waves up to the layer to see whether they were reflected by it and came back. The experiment was entirely successful for the reflection was proved. Moreover, by marking the waves by a slight change of wavelength it was possible to measure their time of travel to the upper atmosphere and

back. In this way the position of the reflecting layer was identified and its height above ground (60 miles) determined. The method used was what we would now call 'frequency-modulation radar'.

The ionosphere was thus the first 'object' to be detected by radiolocation, and Sir Edward Appleton's experiment led to a great development of radio research, and to a military invention of the highest importance which played a signal part in World War II.

Dr. Appleton was at that time in his early thirties, and had just become Professor of Physics in the University of London. He is a Yorkshireman, and was born on September 6th, 1892 in Bradford, where he was educated at Hanson Grammar School. He went to Cambridge as scholar and exhibitioner of St. John's College, and took his Natural Science Tripos in 1913 and 1914 taking Physics for Part II. He won the Wiltshire Prize in 1913 and the Hutchinson Research Studentship in 1914. He was a pupil of both Sir J. J. Thomson and Lord Rutherford in Cambridge.

His studies were interrupted by the outbreak of war, and he joined a Yorkshire Regiment, the West Riding Regiment, later transferred to the Royal Engineers. After the war he returned to Cambridge and devoted himself to research on radio waves. In 1920 he was appointed Assistant Demonstrator in Experimental Physics at the Cavendish Laboratory. Two years later he became Sub-Lector at Trinity College.

Dr. Appleton was appointed Professor of Physics in the University of London in 1924, and remained there for twelve years, untill in 1936 he went back again to Cambridge to the Chair of Natural Philosophy. In 1939, the year war broke out he was appointed to the post of Secretary of the Department of Scientific & Industrial Research—the senior British Government post concerned with physical sciences.

It was under the auspices of the Department's Radio Research Board that Sir Edward Appleton carried out his early experiments, and the Board sponsored his later work which had important results, notably the possibility of direct round-the-world broadcasting. In 1926 he discovered a further layer in the atmosphere 150 miles above ground, higher than the Heaviside Layer and electrically stronger. This layer, which has been named the Appleton Layer, reflects short waves round the earth.

In 1929 Sir Edward Appleton made an expedition to Northern Norway on radio research, studying the Aurora Borealis; in 1931 he published the results of further research on determining the height of reflecting layers of the ionosphere, including the use of a transmitter that sent out 'spurts' of radio energy, and the photography of the received echo-signals by cathoderay oscillography.

This research provided the basis of the technique developed a few years later for aircraft detection, when Sir Robert Watson-Watt and his group of scientists, working on Sir Edward Appleton's scientific findings, brought Britain's secret weapon to perfection. Moreover research workers from the Commonwealth who had previously used Appleton's scientific technique when working with him in Britain, all became leaders in the practical development of radiolocation or radar in their respective countries. Sir Robert Watson-Watt has stated that, but for the scientific work of Appleton, radar would have come too late to have been a decisive influence in the Battle of Britain.

With Dr. J. S. Hey, of the Ministry of Supply, Sir Edward announced in 1946, their discovery of the violent emission of ultra-short radio waves from sunspots, such emission being many million times the expected intensity.

Sir Edward's work as an administrator, as Secretary to the Department of Scientific & Industrial Research, was outstanding. So also was his ability to present to the lay world the story of the advances of science.

In August 1945 Sir Edward Appleton gave a broadcast on the subject of wartime atomic research. He himself was a member of the Scientific Advisory Committee of the War Cabinet which in 1941 advised the Government that the manufacture of an atomic bomb was feasible. Later, under Sir John Anderson, and as technical head of the Department of Scientific & Industrial Research, he assumed administrative control of all British work on the subject. In 1943 he paid a visit to the United States and Canada to arrange the details of the collaboration between American and British scientists.

Sir Edward cotinued to carry out research even while occupied with the arduous administrative duties of Secretary of the D. S. I. R. He has demonstrated that ionospheric reflecting power varies with sunspot activity; another piece of research was his work on radio reflections of meteorites and his discovery (with J. S. Hey) that sunspots are powerful emitters of short radio waves. An important result of his work has been the establishment of a system of ionospheric forecasts, in which more than 40 stations all over the world cooperate, enabling the production of the most suitable wavelengths for communication over any particular radio circuit.

Sir Edward Appleton was elected a Fellow of the Royal Society in 1927 shortly after the success of his first big experiments; he was later awarded the Society's Hughes Medal, was created K. C. B. in 1941 and G. B. E. in 1946. Many countries have honoured Sir Edward, and many Universities have given him honorary degrees. In 1947, the year in which he received the Nobel Prize, he was also awarded the U. S. Medal of Merit, their highest civilian award, and was made an Officer of the French Legion of Honour.

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He was also awarded the Norwegian Cross of Freedom for his war work. India, Norway and Denmark are among the countries which have recognized his work, and he was in 1948 appointed by the Pope to the Pontifical Academy of Science. Among British medals and awards his most recent was the Albert Medal of the Royal Society of Arts, which he received in June 1950 for 'outstanding services to science and industrial research'. He was elected President of the British Association for the Advancement of Science for the Liverpool Meeting 1953.

He holds various important positions in the radio world, is Chairman of the British National Committee for Radio-Telegraphy and Honorary President of the International Scientific Radio Union. In 1932 he was elected Vice-President of the American Institute of Radio Engineers. A man of strong physique and great energy, he possesses remarkable versatility, and during the recent war he studied, apart from his radio research, subjects as various as high explosive bombs, civil defence, dehydration, building design and fuel economy.

As one of the senior workers in British radio he not long ago expressed the view that the future of that subject is abundantly safe in the hands of the brilliant young people now coming along. For shear originality, he said, they can hold their own with their opposite numbers in any country in the world.

DR. D. S. KOTHARI

Dr. Daulat Singh Kothari, M. Sc. (Allahabad), Ph. D. (Cambridge), F. N. I., Chairman, University Grants Commission, Chairman of the Research and Development Advisory Committee of the Ministry of Defence, and Hony. Professor of Physics, University of Delhi, was born in 1906.

Appointed on staff of Allahabad University in 1928, he joined the Delhi University in 1934 and continued there up to March 1961 when he relinquished the appointment of Professor of Physics and Head of the Department to take up the post of Chairman, University Grants Commission. He was also the Scientific Adviser to Minister of Defence and Chairman of the Research and Development Advisory Committee of the Ministry of Defence. He relinquished the appointment of Scientific Adviser when he joined the University Grants Commission but continues to be the Chairman of the Research & Development Advisory Committee of the Ministry of Defence, He research

of the Indian Physical Society, Vice-President of the National Institute of of Sciences of India, and President of the Physics Section of the Indian Science Congress. He has been elected General President of Indian Science Congress Session of the Jubilee Session to be held in 1963. He is a member of the Governing Body of the Council of Scientific and Industrial Research and Chairman of its Aeronautical Research Committee.



DR. D. S. KOTHARI

Professor Kothari has numerous publications in the field of quantum statistics, properties of degenerate matter, magneto-hydrodynamics, theory of white dwarfs and pressure ionization. He has shown on the basis of the theory of ionization that a steller body composed of degenerate matter cannot be larger in size than Jupiter. He has published several papers on the connection between statistical mechanics and the partition theory of numbers; the theory has also been applied to the degradation of polymers. Recently he has developed a theory of fragmentation of steller bodies. Author of *Nuclear Explosions*, published by the Publications Division of the Government of India, 1st ed. 1956, 2nd ed. 1958; translated into German and Japanese.

12. ACTIVITIES OF THE LOCAL CENTRES :

In a country like India with its vast and diverse outlook, it is not possible for any Institution like ours to function effectively unless its members in various regions take active interest and locally organize the activities of the Institution. In a country of the dimensions of India, it is not possible for members frequently to travel long distances to attend technical meetings, lectures etc., which the Institution may organise from time to time. It has, thus become necessary to create local centres in places where there is fair degree of concentration of members. Six such active local centres of the Institution have been set up at Bangalore, Bombay, Calcutta, Jabalpur, Madras and Poona. We hope more local centres will come into existence shortly.

The local centres continue to maintain their activities. The activities of of the various centres during 1961-62 are given below:

Bangalore :

Chairman: Shri S. K. Kanjilal Hony.Secy: Shri H. J. Mirchandani.

The Annual General Meeting of the Institution of Telecommunication Engineers, Bangalore Centre was held at Madras Woodlands Hotel, Sampangi Tank Road, Bangalore on Sunday, 26th November 1961 at 6.30 p.m. with Prof. M. S. Thacker, Director General of C. S. I. R. as the Chief Guest. A large number of members of the Institution were present on the occasion. In addition, several distinguished visitors responded to the invitation. Among them may be mentioned Prof. Whitfield, Professor of Control Engineering, Airforce College, Cranfield, England and Dr. Hooten of the National Aeronautical Laboratory, Australia.

Prof. S. V. Chandrasekhar Aiya, the retiring Chairman, in welcoming Prof. Thacker, the Guest, enumerated the qualities of Prof. Thacker, particularly his capacity to listen to and take in new ideas and act with courage. He specifically mentioned a large mind and a large heart as the characteristic qualities of Prof. Thacker. He then congratulated Shri S. K. Kanjilal for his being unanimously elected as the Chairman of the local centre for the year 1961-62. He mentioned that Shri Kanjilal has been associated with the Institution since its inception and has given generously of his time and experience in building up the Institution, particularly in drafting its constitution, rules and regulations.

Prof. Aiya also mentioned the great and significant changes that are taking place in technology in general, and in electronics and communications in particular. Against a background of such changes, he mentioned, it is necessary for every communication engineer to keep in touch with latest

developments not only in pure science but also in the allied branches of engineering. Keeping this in mind, several lectures and activities of the Institution were organised during the year 1960-61 and the response of the members by way of attendance etc. was most encouraging.

Prof. S. Sampath presented the Annual Report of the local centre. While doing so, he mentioned the different lectures that were arranged during the year as also the visits.

Shri Kanjilal was then installed as the Chairman for the coming year by Prof. S. V. C. Aiya. Addressing the members, Shri Kanjilal recalled his 27 years of experience in the Posts & Telegraphs Department, pointing out the great changes that have occurred during that period in this country. He looked forward to much greater changes, particularly on the manufacturing and production side.

Prof. Thacker, in his address as Chief Guest, recalled his association with the Institution and mentioned significantly that he is an Honorary Fellow. Referring to the remarks of Prof. Aiya regarding the excellent work that Prof. Sampath was doing for the Institution and at the Indian Institute of Science, and his impending departure to the Indian Institute of Technology, Madras, Prof. Thacker said he was glad that the Institute of Science was providing a valuable person to the Indian Institute of Technology, Madras. Continuing his address he mentioned his close association both with the technical education and scientific research and the problems he had to face in shaping both for the present and for the future. He particularly stressed the need for the new ideas and quick changes for keeping in pace with the developments abroad.

Shri H. J. Mirchandani proposed a vote of thanks to Prof. Thacker and others.

A meeting of the Institution of Telecommunication Engineers Bangalore local centre was held on the evening of 19th March 1962 when Mr. B. Vallantin, Visiting Professor, Indian Institute of Science, Bangalore addressed the members of the Institution. Mr. Vallantin indicated the history of the development of high frequency vacum tubes (microwave tubes) and briefly described the developments that took place from 1880 onwards. He then gave a brief description of the construction of Klystron, Magnetron, Pierce Travelling Wave tubes ('O' and 'M') and also described the Carcinotron the latest microwave tube. He described the advantages over Klystron (30 times more efficient) and also the disadvantage of Carcinotron (pulling).

The lecture was presided over by Shri S. K. Kanjilal, Chairman of the local centre at Bangalore and was well attended.

Delhi.

Dr. S. J. Lewandowski, Head of the Microwave Laboratory, Institute of Physics, Polish Academy of Sciences and Technical Adviser to Polish Foreign Trade Co. "Electrim" addressed the members of the Institution at Delhi on 12th December 1961 on "Microwave Faraday Rotation Devices."

Rotation of the plane of polarization of a plane wave passing through a medium magnetized by a steady magnetic field. H_o is known as "Faraday effect". The effect was first observed at optical wave-lengths by Faradayhence the name—and recently (1951) Hogan reported Faraday rotation occurring in ferrites at microwave frequencies. Boardly speaking, the effect occurs as a result of interactions between R. F. magnetic field and the fields produced by elementary magnetic particles of the medium. Precession of electron spins around the direction of H_o causes the medium not to present any longer equal magnetic permeabilities for circularly polarized R. F. fields, applied transversely to the H_o and of frequency comparable to the frequency of precession. Different permeabilities encountered by circularly polarized components of plane wave result in a rotation of the plane polarization. Mathematically, the anisotropic properties of a magnetized medium are expressed by adopting the permeability of the medium in a dynamic form.

Practical applications of Faraday rotation in the microwave region rely on two unique properties of this effect; non-reciprocity and dependence on H_o value. By non-reciprocity we mean that if the same wave travels through the medium twice, but in opposite directions, (e. g. incident and reflected wave) the total rotation would be doubled, and not cancelled, as one would normally expect. This property can be explained by recalling the fact that in describing the physical mechanism responsible for the effect, direction of the wave does not enter the picture and the effect, considered in a fixed coordinate system, will take place exactly in the same manner, regardless of the direction of propagation (but not regardless of H_o direction).

Non-reciprocal properties of Farady rotation render possible the design of certain new elements of microwave circuits; isolators and circulators which are passive networks violating the reciprocity law. Dependence of the rotation on magnetizing field value enables to execute the control of old transmission path parameters by purely electronic means, what was previously impossible in microwave techniques. There is a wide variety of devices using the last property: modulators switches, variable attenuators, etc. Possibilities are always open to enable design engineers to combine the two basic properties in a single device in order to meet the particular requirements of the system.

Each Faraday rotation device, independent of its type, incorporates one component part of common design; it is a section of circular waveguide

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containing a coaxially mounted ferrite rod, magnetized longitudinally by external D. C. field. The circular waveguide is excited in its dominant TE_{11} mode, as this mode is linearly polarized. Symmetry of the chosen configuration allows for free rotations of the field pattern, caused by the Faraday effect. This 'Farady rotator' is usually terminated at both ends by rectangular to round guide transitions which serve a double purpose : first, as connecting devices -because of the microwave systems use rectangular waveguide (TE₀ mode); second, as devices fixing the plane of polarization of the wave entering the rotator, and picking up the right polarization of the emerging wave respectively. For example, transitions of ferrite isolator are rotated for 45° with respect to each other, while the Faraday rotation is also set to be equal to 45°. Microwave power will pass through such a device freely in only one direction because for the other one, due to non-reciprocity of Faraday effect, the emerging wave will have its electric field vector directed along the broad lace of the output rectangular guide ('analyser'). Proper isolating action is now obtained by placing inside the rotator a thin absorbing vane, mounted parallel to the broad wall, of the analyser, which will absorb the undesired wave. In a Faraday rotation circulator the absorbing vanes are replaced by two additional rectangular guide terminals which are designed to pick up only the wave of polarization normally absorbed by the vanes. This arrangement produces a 'circulation' of microwave power inside the device-that is, if the terminals are suitably numbered direct connection exists between them only in the order of increasing numbers, e.g. from 1 to 2, from 2 to 3, from 4 to 1, etc.

Main problem in designing the Faraday rotation devices is finding the proper geometry of the rotator itself. The following conditions must be taken into consideration in the design :

- (1) Smallest possible losses in the devices
- (2) Broadband performance (rotation independent of frequency).
- (3) Small dimensions of the devices (compactness)

The listed conditions are contradictory: for example, low loss performance can be obtained with very thin ferrite pencils, but this will result in excessive length of the ferrite. It follows that reasonable compromise must be reached and that is possible only after patient experimental investigation, as there are many factors to be accounted for, the theoretical approach can dispose only a few of them and even that involves lengthy calculations. Recently some efforts are done to utilise calculations made by electronic computers and to check the theoretical predictions with the experiment.

Dr. M. Morita, Chief of Engineering Department of Radio Industry Division in the Nippon Electric Co. Japan delivered a lecture on 27th March 1962 on "The Latest Developments in Microwave Communication Techniques". Shri C. P. Vasudevan presided over the meeting.

Dr. Morita said that we have three objectives for the progress of Microwave communication technique, viz. (1) to transmit larger quantity of information using one radio frequency, (2) to transmit information over a longer distance and (3) to reduce the size, weight, power consumption and the cost of equipment. The most important factors which limit the number of channels in large capacity microwave communication systems are thermal noise and intermodulation noise. The former is determined by various factors such as transmitting power, noise figure of receiver, antenna gain, fading depth, modulation index etc. Intermodulation noise has been divided into two categories, one the non-linear distortion noise and the other linear distortion noise. The latter has been called delay distortion because it is caused by the difference in delay time for various frequencies, when the frequency modulated wave is transmitted through a certain network. Recently, however, another factor which is of considerable importance as a cause of intermodulation noise in large capacity microwave system has been found. This is the distortion due to the amplitude frequency response of I. F. amplifiers. If the amplitude frequency response is not flat, then the relative amplitude between the first and second F. M. sidebands would be changed, after passing through the network, which means, a new side band wave has been generated, cause lating frequency vary high. This fact, had not been noticed till recently. He said that the Engineers of Nippon Telegraph and Telephone Public Corporation and Nippon Electric Company Ltd. have discovered the phenomenon and developed the equalizer to remove this distortion.

The reason why this kind of distortion had not been discovered earlier is that, this distortion predominates only when the modulating frequency is very high. Therefore, in the existing microwave systems which have the capacity of several hundred channels, linear distortion due to the amplitude frequency had not been noticed.

He then dealt with the high sensitivity Receiving systems in over-the horizon communication. The recent developments of high sensitive, receivers and parametric amplifiers have resulted in remarkable reduction of transmitter power and the installation and maintenance cost has become more economical than the line of sight system in same conditions. He also gave detailed principles of high sensitive receiving system for F. M. as well as for A. M. Both these two systems are likely to be used in many applications including space communication, mobile ratio, line of sight and over- the- horizon communication.

The recent developments of semi-conductors are so remarkable that the vaccuum tubes which were used in microwave repeaters are being replaced by the solid state devices. Still another remarkable progress in semi-conductors on microwave application is the variable capacity diodes. The appearance of such diodes enabled the development of parametric amplifiers and promoted the realization of solid state microwave source. By using variable capacity diodes, the efficiencies of frequency multipliers in U. H. F. and S. H. F. range have been improved very much.

Lastly, he explained, the present practice of the line-up of microwave power source. Using transistor oscillators, transistor frequency multipliers and amplifiers, upto 10 watts in 100-150 mc/s., range is obtained and this is then frequency multiplied upto several thousand megacycles, by using variable capacity diodes. By means of this technique, development of all solid state microwave repeater has become possible although number of channels to be transmitted is limited because of the limited transmitted power at present state. The merits of solid state microwave repeaters are (i) miniaturisation of size and weight, (ii) the replacement of vacuum tubes becomes unnecessary, results in reduced failure rate, as well as reduced maintenance cost. (iii) power consumption is remarkably reduced, (iv) increased reliability with reduced cost as an overall installation.

Dr. M. B. Sarwate, Deputy Secretary General of International Telecommunication Union, Geneva addressed the members of the Institution on 25th July, 1962 on "Recent developments in space communication". Dr. Lal C. Verman, President of the Institution, was in the chair.

Dr. Verman introduced the speaker with the following remarks. "Dr. Sarwate is a well-known figure in the field of telecommunication engineering in India and is now in the helm of affairs in the International Telecommunication Union and as such the subject of his talk was the most appropriate one"

Dr. Sarwate said that the subject of space telecommunication is particularly important to the telecommunication engineers because of its vast potential in the field of communication at short and long distances. The idea of space communication is not new, Arthur C. Clark proposed as early as 1945, satellites for relaying and broadcasting. The year 1957 was the beginning of space flight and space communication. The first Russian sputnik launched on 4th October 1957 followed by a bigger one in the same year. This was followed by launching of satellites by United States leading to the development of space telecommunication by satellites. In December 1961, the United Nations Assembly adopted Resolution 1721 on the peaceful uses of outer space in which it recognised the role of the I. T. U. as a specialised agency responsible for the development and regulation of space telecommunications.

After explaining at length the main problems and limitations of the global telecommunication, he said, the communication through satellites should obviate many of the difficulties enabling a high degree of reliable communications. There are two systems by which the telecommunication through satellite is possible. The first one is passive satellite which reflects the radio signals. The second is the active satellite which amplifies and transmits to another point on the surface of the earth. Satellites are of two fundamental types, viz. high orbit and low orbit system. He further stated the merits and demerits of each system. With regard to the orbit of the satellite, an elliptical one is preferable. The total power required to put a satellites may be placed in a polar orbit so that at least one satellite will pass within communication range of every point on earth at least once during each satellite orbital period. Six such satellites are required for satisfactory world-wide communication.

Dr. Sarwate explained at length the system of relatively high altitude active repeater satellites which provide the ultimate world-wide communication. Here a single satellite is used both for receiving and transmitting. Regarding different orbital configurations, he said, synchronous, non-synchronous satellites and stationery satellites are possible. The synchronous satellite is very useful since it allows fixed directional antennas to be used on the ground and easy acquisition.

Regarding the selection of optimum frequency for space communication, it has been found that frequencies between 100 Mc/s to 8000 Mc/s are suitable. Then he also dealt with antenna system, its requirements for satisfactory satellite communication. He concluded his talk, with the problems which confront the space telecommunication, such as longivity of solar cells, space environment radiation hazard and hard vacuum.

The meeting ended with a vote of thanks by Shri C. P. Vasudevan, Director, Telecommunication Research Centre, Posts and Telegraphs, New Delhi. Shri Vasudevan thanked Dr. Sarwate for the masterly manner in which Dr. Sarwate presented the subject.

Jabalpur.

The first meeting of the local centre for the year 1961-62 was held on Monday, 27th November 1961 at the Government Engineering College, Jabalpur. The meeting was attended by about 300 members and non-members.

Dr. S. M. Dasgupta, Professor of Electrical Engineering, Maulana Azad College of Engineering, Bhopal, spoke on "Some Mathematical Operations by Electronic Methods." He started with the fundamental concept of addition,

multiplication and integration which included subtraction, division and differentiation and explained at length the principles of operational amplifiers, scale changers etc., with typical circuits to show how they could be used satisfactorily as tools to solve and study the results of intricate problem involving difficult differential equations.

Dr. Dasgupta then stressed on the following steps to design an equipment, e. g. (a) preliminary study, (b) mathematical knowledge, (c) study of such knowledge, (d) evaluation of result, (e) re-examination of all results, and finally (f) construction of model and said that with an operational amplifier, mathematical knowledge was utilised to know the importance of each factor. He took the example of the mechanical suspension system of an automobile where the shock absorbers and the springs were needed and formed two mathematical equations from the considerations of the disturbances due to undulation of roads and the oscillations created thereof on the body of the automobile. He called the equations as the mathematical model and studied them with operational amplifiers and scale changers to evaluate the result and showed the different design considerations of the shock absorbers to be used from the different oscillograms obtained by taking different conditions of road and other factors. He then finally explained how it becomes easier to study very difficult problems with the help of computers in order to build up an equipment.

There was a lively discussion when Dr. Dasgupta finished and the meeting was then adjourned with a hearty vote of thanks by Shri P. C. Pal, Honorary Secretary of the Jabalpur local centre.

The Second meeting of the Jabalpur Centre for the year 1961-62 was held on Saturday, 19th Jaunary 1962, at the Government Engineering College, Jabalpur. The meeting was attended by about 60 members and non-members.

Shri S. N. Verma, Student, Final year Telecommunication Engineering, spoke on "Solar Cells" and Shri S. K. Bhatia, Student, Final year Telecommunication Engineering spoke on "Fuel Cells" under the broadhead "Recent Developments in Electricity Cells."

Shri Verma, the first speaker, started, with different sources of energy to be required for space vehicles such as chemical sources, nuclear sources and solar energy sources and described the advantages and disadvantages of the above sources from which it was found that the solar energy sources were preferable as there were no moving parts and as they did not add much weight to the whole system. He then described the different types of solar cells one by one such as the vacuum type, low pressure caesium vapour type, high

pressure caesium vapour type and the thermionic solar cells such as thermionic solar powered diodes. He said that these cells gave efficiency ranging from 5 to 10 per cent for working temperatures ranging respectively from 3700 to $2500^{\circ}K$ with an average output of 15 watts/cm² and the rest of the concentrated energy was lost due to the absorption losses from irregularities on the reflector absorptivity and enclosure losses. But thermionic solar cells, according to him, had got efficiency as high as 17 per cent with an average output of 30 watts/cm² at 2400°K and were light in weight and were of low cost. Materials used as emitter for such cells were tantalum, zirconium oxide and uranium oxide. Shri Verma finally concluded by saying that thermionic solar cells were not affected by Van Allen radiations and solar storms.

Shri Bhatia, the second speaker, started with the necessity of fuel cells as compared to other chemical cells so far as output and efficiency were concerned where the D. C. electrical energy was available from the chemical energy without an intermediate heat step. According to him, the conversion efficiency of fuel cells were as high as 70-80 per cent as compared to about 45 per cent of turbo-alternators and the fuel cells were 30-35 times better than Ni-Cd cells in so far as energy per unit weight was concerned. He then described types of fuel cells employing different types of fuel oxidizer, electrotypes and different conditions of temperature and pressure and said that the cell employing H₂ as fuel and oxygen as oxidizer with nickel electrodes at working temperature from 60 to 240°C and at pressure form one atmosphere to 50 atmospheres was better than other types if energy per unit weight, power, density and reliability were compared. Difficulties with fuel cells, according to him were the following ; (1)there was a drop of efficiency as the load was increased, (2) with increase of current, the terminal voltage dropped, (3) corrosion difficulties were there at high temperature and pressure, and finally, (4) the cells gave D. C. which could be utilized for resistance loads only. Concluding, Shri Bhatia explained different uses of fuel cells such as in satellites, remote controlled radar and microwaye stations, submarine propulsion, short-range transport planes and helicopters, truck and car propulsion and power supplies for T. V. and microwave repeater stations D. C. transmission and auxiliary and emergency power supply.

The lectures were profusely illustrated by charts and figures. The meeting was then adjourned with a hearty vote of thanks.

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The third meeting of the Jabalpur centre was held on Saturday, 20th January 1962, at the Government Engineering College, Jabalpur with Prof. V. V. Sarwate in the chair.

Shri R. K. Nigam, B. E. (Hons.) spoke on "Transients in Electrical Networks", Shri Nigam started with the explanation of the transient and steady state

behaviour of the voltage and current in an electrical network, the former being non-repeating in nature while the latter being of a periodic function of time. He then explained the desirable and undesirable types of transient nature, the desirable types being the real sound, the instrumental music, the modulation and timing control in T. V. systems, self-regulation in all self-controlled systems for the control of industrial machines and processes, etc.; while the undesirable types, according to him, are the lightning, man-made atmospherics, storm in the air vibrations, sound variations in auditorium and broadcasting studios, etc. Shri Nigam dealt with in detail, the four methods of analysing the the transient behaviour in electrical networks, namely (a) Classical method, (b) Heaviside operational calculus method, (c) Fourier and Laplace transform method, and (d) Fourier integral method, out of which, according to him, Laplace transform method was the best which he showed by taking typical low pass filter circuit.

The meeting was then adjourned with a hearty vote of thanks.

An Electronic Exhibition was organised by the Institution of Telecommunication Engineers, Jabalpur Centre, at the Government Engineering College, Jabalpur on 29th January 1962 in which many persons took part.

The exhibit 'Radio Controlled Electric Train' by Shri Ram Krishan Namdeo, student of second year class, Government Engineering College, Jabalpur was considered to be the best and Shri Namdeo was awarded the first prize in the competition in the exhibition.

The fourth technical meeting of the Jabalpur local center was held on Monday, 19th March 1962 at the Telecommunication Training Centre, Posts and Telegraphs, Jabalpur with Prof. V. V. Sarwate, Chairman of the center in the chair.

The Chairman introduced the speaker Shri M. K. Basu, Assistant Wireless Adviser, Ministry of Transport and Communications, New Delhi who had come to Jabalpur.

Shri M. K. Basu spoke on "International Radio Consultative Committee (C. C. I. R.) and some of its Recommended Study Programmes". He explained how the study programmes adopted and recommended by the C. C. I. R. had assumed great importance for wireless communication services in India. A close collaboration was desired to be maintained, through participation in the C. C. I. R., study programmes between the Universities and Research Institutions and the Ministry of Transport and Communication which co-ordinates the studies in India under C. C. I. R. Programme and represents the Government of India in the International Telecommunication Union.

The speaker explained the purposes and functions of the International Telecommunication Union (I. T. U.) and its permanent organs. International Radio Consultative Committee (C. C. I. R.) was established in the International Telecommunication Union in 1927 as a permanent organ of the Union. Its duties are to study technical and operational questions relating specifically to radio communication. It works through the medium of Plenary Assembly meeting normally held once every three years and Study Group meetings dealing with questions and programmes to be studied, where various members and associate Member countries of I. T. U. participate. It has fourteen Study Groups dealing with specific subjects, such as Transmission, Reception, Fixed Services, Mobile Services and Space Systems, Sound Broadcasting and Television Propagation, Standard frequencies and Time signals, International monitoring etc. The importance of C. C. I. R. to wireless communication services is in that the technical standards evolved by the C. C. I. R. considerably influence the shaping of International Radio Regulations which are mandatory to the member countires of I. T. U.

Shri Basu explained how India has taken active interest in the work of the C. C. I. R. particularly since 1947. Large developments and advances in the field of Wireless communication have taken place in India during recent years. India cannot any more remain satisfied by accepting standards evolved on the basis of data collected by other countries. This was apparent during the C. C. I. R. Plenary Assembly in Los Angeles, 1959, and in the Administrative Radio Conference, Geneva, 1959. To safeguard India's further interest in this regard, it is now more necessary to utilize, as much as possible, the available resources and talent in the country for the study of the C. C. I. R. problems. Universities can make valuable contributions in this field.

The speaker said that though many of the present C. C. I. R. questions and study programmes pertain to particular specialized services like Overseas Communications Service, Broadcasting etc., there are a large number of problems which are of interest to all users of wireless and study of these problems can be taken up conveniently by the universities with their available resources. He then explained the scope of the following study programmes :

- (1) Limitation of unwanted radiation from industrial installations.
- (2) Usable sensitivity of radio receivers in the presence of quasi-impulsive interference.
- (3) Distortion in frequency modulation receivers due to multi-path propagation.
- (4) Directivity of antenna at great distances.
- (5) Determination of the electrical characteristics of the surface of the earth.
- (6) Tropospheric wave propagation.
- (7) Study of sky-wave field strengths on frequencies between the approximate limits of 1.5 and 40 mc/s.
- (8) Measurements of man-made radio noise.
- (9) Measurement of atmospheric radio noise.
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Finally, as an example, Shri Basu discussed the results of the atmospheric radio noise measurement which was being carried out during the last two years at the International Monitoring Station at Delhi as a part of the C. C. I. R. world-wide study programme and illustrated how the results suggest revision of the existing prediction and curves of atmospheric radio noise in C. C. I. R. Report 65.

There was a lively discussion after the speaker back finished and the meeting was adjourned with a vote of thanks.

By far the largest number of members of the Institution is concentrated at Delhi. Since most of the members of the Institution are drawn from organisations in the public sector it is but natural that there will be a concentration of members in and around Delhi. In addition, being the capital of India, where the headquarters of all the Ministries and departments of the Government of India are situated, Delhi attracts a number of distinguished engineers and scientists form abroad. The Institution always takes opportunity of inviting distinguished persons to address the members of the Institution on subjects of their special interest.

13. LIBRARY :

A well organised library is an asset to any professional organisation like ours. We have been considering the possibility of creating such a wellequipped library but with our meagre financial resources we could not make much of a progress. However, we have already collected some books and journals received for review and on exchange basis respectively. It was not possible to think of a full-fledged library without outside aid. The Council readily agreed to a suggestion by the Honorary Secretary to request the Ministry of Scientific Research & Cultural Affairs for a suitable grant for Institution. An appeal was made in January 1962 to the Ministry of 3. R. & C. A. Son a grant of Re. 5 lakks for the purchase of books and journals. The Honorary Secretary had a series of meetings with the officers of the Ministry of S. R. & C. A. and impressed upon them the urgent need for the grant-in-aid. It is gratifying to note that the Ministry of S. R. & C. A. readily responded to our request and made available an amount of Rs. 50,000/- in the first instance for the purchase of books and journals. It is a generous gesture on the Institution and the Council gratefully acknowledges this help by the Ministry of S. R. & C. A. This grant from the Ministry of S. R. & C. A. will go a long way in meeting the ever-increasing demands of our Student members in particular and others in general for suitable text-books for the preparation of their examinations. The letter from the Ministry of S. R. & C. A. conveying the sanction of a sum of Rs. 50,000/- for the purchase of books for the library of the Institution is reproduced below :

GOVERNMENT OF INDIA

MINISTRY OF SCIENTIFIC RESEARCH & CULTURAL AFFAIRS

No. F. 21-34/61-T. 4 New Delhi, the 12th March 1962, 21st Phalguna, 1883 (Saka).

From : The Assistant Educational Advisor (T),

Government of India. : The Honorary Secretary,

To :

The Institution of Telecommunication Engineers, Post Box No. 481, New Delhi.

Subject : Payment of ad-hoc grant-in-aid to the Institution of Telecommunication Engineers, New Delhi.

Sir,

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I am directed to refer to your letter No. ITE/Grant dated the 25th January 1962 on the subject mentioned above and to convey the sanction of the President for payment to you of a sum of Rs. 50,000/- (Rs. Fifty thousand only) as an ad-hoc non-recurring grand-in-aid for purchase of books and journals for the library of the Institution, for use of the students appearing in the professional examinations in Telecommunication Engineering conducted by the Institution. The Institution should furnish in due course an utilization certificate together with a list of books and journals purchased and their prices.

The expenditure involved is debitable to the Sub-Head B. 1(4) (3)-Educational and Literary Organisation (Non-plan Expenditure) Recurring grant-in-aid for promotion of Technical Education in India, Demand No. 81-S. R. & C. A.-Major Head 36--and will be met reappropriation of Savings under the same demand.

The bill for the above amount in T. R. 42 may kindly be sent to this Ministry in the first instance for the countersignature of Shri M. V. D. Nair, Assistant Educational Advisor (T), to the Government of India together with a certificate that the amount will be spent for the purpose for which it has been sanctioned and thereafter presented to the Treasury Officers, New Delhi, for payment before the 31st March, 1962.

I am to add that the Institute should maintain an Assets Register in accordance with the proforma prescribed in this Ministry's letter No. F.21-61/60-T. 4 dated the 10th August 1961 (copy enclosed).

Yours faithfully, Sd- M. V. D. NAIR Assistant Educational Adviser (T)

The Institution also gratefully acknowledges the generous grant of scientific journals from the British Information Service. The list of journals received from the British Information Service is given below:

Proceedings of the Royal Society, Vol. 187-190, 192-199, 201-205, 235-236,

239-241, 244-256, and 260-264.

The list of books available in the library of the Institution received through book reviews as well as purchased from the grant received from the Ministry of S. R. & C. A. is shown in Appendix IV.

The list of Journals received through exchange from various organisations in India and abroad is shown in Appendix V.

We have approached the publishers of about 200 standard scientific and technical journals all over the world to establish exchange relationship with our journal and the response so far has been very satisfactory. We hope that in a year or so we shall have at least the beginnings of a well equipped library.

14. OBITUARY :

PROFESSOR K. S. KRISHNAN, F. R. S.

In December 1958 Dr. Krishnan's sixtieth birthday was celebrated with great deal of enthusiasm and affection in many parts of the country and specially so in Delhi. Not only scientists, friends and students gathered in strength to felicitate him, but many literary societies and religious institutions



PROFESSOR K. S. KRISHNAN, F. R. S.

vied with each other to honour him. To some of us who had the privilege to be present at these celebrations the affectionate tributes paid to him by one and all are still ringing in our ears. All wished him many more fruitful years. The Prime Minister, in his characteristic way said, "What is there about a 60th birthday; to a person who has attained the age of 69, 60 seems a ridiculously small age". How one wishes the fond hopes and prayers of all his well wishers had borne fruit !

But then, in his reply to the felicitations he refers to his heart attack earlier and describes his feelings at the imminence of death and says; "It is not a terrifying experience. That was what I found. I felt if the end is to come probably this is the gentlest and the happiest way". His wish was fulfilled. He passed away few minutes after the second attack at night on the 13th of June 1961, while talking to his family members, before a doctor could arrive.

Dr. K. R. Ramanathan, very close friend and colleague of Dr. Krishnan ever since the Bow Bazaar days at Calcutta, has this to say :

"Creative thinkers like Krishnan with understanding, critical judgement and tolerance, man who have a mind of their own and carry out their inner *Dharma* unperturbed by changing fashions, men who "explore the explorable and quietly venerate the inexplorable" are not to be found in large number in any country, when we do find such persons we do well to honour them."

Prof. Kariamanikkam Srinivasa Krishnan was born in the village of Watrap near Srivilliputtur in Thirunelveli district (now Ramnad), Madras State. His early schooling was in Watrap and Srivilliputtur, followed by college education in the American College at Madurai and later in the Christian College Madras. After graduating in Physics from the Christian College, he was for a few years a Demonstrator in the same college.

Being of an enquiring turn of mind he went to Calcutta to study Physics under Prof. C. V. Raman. He joined the University College, Calcutta for his M. Sc. Prof. Raman had a profound influence on Dr. Krishnan who absorbed from the Nobel Laureate a deep and abiding interest in Optics and Molecular Physics. Though Prof. Krishnan, for some reason did not take the M. Sc. examination, Prof. Raman, accepted him as a research student in the Indian Association for the Cultivation of Science.

Here follows an account by Prof. Ramanathan, an eminent scientist, on the scientific contributions made by his distinguished friend while at Calcutta, Dacca and Allahabad :

"The period of Krishnan's stay in the Indian Association for the Cultivation of Science was a period of exceptional activity. The new subject of molecular scattering of light and of X-rays was being rapidly developed by Professor Raman and there were a number of bright young men from all over India working in the Association under his unique leadership in various aspects of the subject. Krishnan entered into his work with great enthusiasm. He made a characteristically thorough experimental study of the scattering of light in a large number of pure liquids, worked on many problems in the classical theory of the diffraction of light and started work on the magnetic anisotropy of gaseous molecules and of crystals (nitrates and carbonates). He collaborated with Prof. Raman in making a detailed examination of the change in the nature of the light which was found to be associated with molecular scattering. As is well known, these studies led to the discovery of the Raman Effect."

"In October 1928, Professor Arnold Sommerfield of Germany was a Guest Professor of the Calcutta University and he delivered a course of seven lectures on modern developments of quantum theory. Krishnan took careful notes of

the lectures. As Prof. Sommerfield says, "the first three and the last two lectures were worked out by Mr. K. S. Krishnan in a very independent way." The lectures were later published by the Calcutta University."

"Prof. Krishnan was in the Dacca University from 1929 to 1933. With Prof. S. N. Bose as Professor of Physics and his old friend Dr. T. Vijayaraghavan Reader in Mathematics, and with Mr. Langley as Vice-Chancellor, Mr. Krishnan found a congenial atmosphere in Dacca and threw himself heart and soul into his teaching and research activities. It was there that he developed his elegant and precise experimental methods to test out the idea that the magnetic anisotropy of a diamagnetic or paramagnetic crystal could be correlated with the anisotropy of the individual molecules and their relative orientations and that in favourable cases the precise orientation of molecules in the unit cell could be determined from magne-crystallic measurements. He worked out simple methods of measuring accurately feeble susceptibilities and anisotropies, making effective use of quartz fibre suspensions and liquid baths of varying susceptibilities for immersing the crystals. With his students, B. C. Guha, S. Banerjee and N. C. Chakravarty, he made measurements on a large number of crystals, both diamagnetic and paramagnetic."

"The papers entitled 'Investigations in magne-crystallic action', which were published in the next few years by Prof. Krishnan and his students in the Philosophical Transactions of the Royal Society and in the Physical Review, are mines of information regarding the magnetic properties of diamagnetic and paramagnetic crystals. The work of Krishnan and his students and of Dr. Kathleen Lonsdale established the fruitfulness of magnetic methods as a valuable supplement to the methods of X-ray analysis for determining the architecture of crystals."

"When Prof. Raman left Calcutta in 1933, Krishnan was invited to take up the post of Mahendralal Sircar Professor of Physics in the Indian Association for the Cultivations of Science. There were no regular teaching duties attached to the post and a return to the old familiar cosmopolitan surroundings of 210 Bowbazar Street was welcome to Krishnan. The magnetic and optical properties of crystals together with their structure analysis by X-rays, and the various ways in which the anisotropy of crystal units manifest themselves in the bulk properties of the crystals continued to occupy his attention. To the second Calcutta period belongs the work of Krishnan, Bose and Mookerjee on the magnetic properties of salts of the rare earth and iron groups including a detailed comparison of their extensive experimental measurements with the conclusions which follow from the theoretical work of Van Vleck and Penney and Schlapp on the crystalline electric fields of such crystals. In paper V in the series on magne-crystallic action published in the Philosophical Transactions

of the Royal Society, there is detailed discussion of the susceptibilities and anisotropies of these crystals and of the conditions which determine to what extent the temperature variation of their susceptibilities will follow the Curie Law. To the same period also belongs a characteristically significant paper by Gangulee and Krishnan on "The magnetic and other properties of free electrons in graphite" (Proc. Roy. Soc. 1941). In this paper, the authors show that the diamagnetism of graphite is almost wholly along the hexagonal axis, that in a graphite crystal, one electron per carbon atom is free to move in the basal plane but not in a perpendicular direction, or in other words, the electrons in such a crystal form a two-dimensional electron gas and that the theoretical properties of such an electron gas can be verified in detail from a study of the magnetic properties of graphite. From the measured values of the diamagnetism of graphite at different temperatures varying from 90° to $1270^{\circ}K$, they conclude that the energy distribution of electrons in graphite conforms to Fermi-Dirac distribution.

"Prof. Krishnan's contributions to physics were recognised by the invitation he received from Lord Rutherford in Cambridge and Sir William Bragg in London to give a course of lectures in the Cavendish Laboratory and in the Royal Institution (1937). He later visited a number of universities in Europe and was awarded the University Medal by the University of Liege for his scientific achievements. In 1939, he was invited to participate in an International Symposium on Magnetism at Strasbourg. Krishnan was elected to the Fellowship of the Royal Society in 1940."

"In 1942, Krishnan was offered the post of Professor of Physics in the University of Allahabad which had been vacant for some years after the departure of Prof. M. N. Saha to Calcutta. Krishnan always enjoyed teaching and discussion. The Professorship in Allahabad gave him an opportunity to review, in a systematic and comprehensive way, before senior students the various problems of classical scattering of light, X-rays and electrons, of statistical thermodynamics, and quantum theory and wave mechanics. Despite the difficult conditions created by the war, Krishnan and his associates were able to do a good amount of investigational work on these subjects. In particular may be mentioned his work with Dr. A. B. Bhatia giving a critical review of Einstein's theory of light scattering in homogeneous media as reflection from thermal elastic waves and a new and illuminating method of summing up the intensities of the elastic waves. They also treated on a unified basis the scattering of X-rays by fluids and of low velocity electrons by liquid metals and by alloys."

"As an offshoot of the analysis of elastic waves in a homogeneous medium caused by fluctuations of density, Krishnan was led to the study of the mathematical problems of the summation of certain infinite series of class

of functions which are of special importance in physics. He showed that with functions whose Fourier transforms satisfy two simple conditions the sum of the infinite series could be obtained just as well by rectangulation as by integration, and that this was not an approximate, but a rigorous result. Krishnan's paper "On the equivalence of certain infinite series and the corresponding integrals" in the Journal of the Indian Mathematical Society (Vol. 12, 1948) shows the range and power of the method.

The start of the second world war brought to focus the gross inadequacy of our scientific and technological organisations and it was felt that there should be an immediate build up of our scientific institutions in a very large way. The Council of Scientific & Industrial Research took shape during the period of this great stress. Dr. Krishnan was in close collaboration with Dr. Bhatnagar right from the formative years of the Council. Even in 1940 he was asked to join the Council and help organizing the various laboratories, and in particular a Bureau of Standards for India. A Planning Committee was set up of which Prof. Krishnan was a member. He, however, did not join the Council though he was actively associated with all the deliberations on the Special Planning Committee for the creation of a National Physical Laboratory as well as the organization of Scientific Research in a planned manner. Finally in 1947, Prof. Krishnan was offered the Directorship of the National Physical Laboratory and as he says, "in the flush of newly gained independence, every problem seemed to recede to the background, in the intense faith that in an independent India every problem would get solved and every defect would get rectified, in due course." Though in the initial stages he had some doubts of the necessity for an organization like the National Physical Laboratory, he appears to have felt in 1947 that "in the growing industrial economy of the country, the organisation of the Bureau of Standards was one of national importance, and I had no doubts in my own mind about it."

Prof. Krishnan was awarded the Bhatnagar Memorial Prize and is the first recipient after its creation. At a function organised at the Laboratory on the 24th March 1961 the award was presented by the Prime Minister. Dr. Krishnan in reply to the citation, gave a review of the work during the period of his tenure at National Physical Laboratory. The review, as can be expected, is a masterly summary of his scientific contributions and is practically his swan song, one might say. Significantly enough he had written down his speech and it was distributed to the audience. To those who knew him this was rather surprising as he generally speaks ex-tempore on such occasions. One could hardly do better than to reproduce his own words in describing his work.

At NPL "My work has been mainly on the physics of the solid state and I should like to refer in particular to three major lines of work. One is the thermionic properties of metals and semiconductors done in collaboration

with Dr. S. C. Jain." A new and very elegant experimental technique was developed which eliminates many of the errors encountered in the classical methods of determining the thermionic constants of metals. "The method was first applied to graphite and is based on the determination of the saturation vapour pressure of an electron gas inside a graphite chamber kept at different constant temperatures. In practice this is done by finding the rate of effusion of the electrons through a small aperture in the wall of the chamber. The method is analogous to that of obtaining black body radiation from the narrow mouth of a heated chamber, which naturally is independent of the walls of the chamber."

By covering the inner walls of the graphite chamber completely with a thick coating of any metal, the constants of the metal can be determined in the same manner. The method has also been applied to semi-conductors by keeping the semi-conductor inside the chamber and in electrical, but not mechanical contact with the walls."

"The thermionic constants for several metals and some semi-conductors have been measured by this method and the results discussed in a series of four papers in the Proceedings of the Royal Society. Among them I would like to refer in particular to the results of the monovalent metals and transition metals, which present some interesting features."

"The experimental methods developed by us in the course of these thermionic studies for the determination of the spectral and the total emissivities of metals have now become more or less standard methods for such determinations."

An interesting problem which is of an applied physical nature and of particular interest to telecommunication engineers arose out of the above investigations. It is the distribution of temperature along a thin rod (or wire) electrically heated in vacuo. In modern electrical technology, electrically heated wires find extensive use in various devices, such as electric lamps, vacuum tubes, X-ray tubes, cathode ray tubes etc. The efficiency of such devices depends largely on the availibility of a copious supply of electrons at as low a temperature of operation as possible. It is a matter of importance to know exactly the temperature along a filament from which the electrons are emitted, in order to create optimum conditions for the production of electrons. Till now certain empirical formulae derived from experience were the sole guides for designers of such equipment.

With the collaborations of Dr. Jain, Prof. Krishnan attacked this problem both from the theoretical and an experimental point of view. "The complete solution and its many implications and detailed experimental verification of

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these implications form the subject matter of a series of six papers, again in the Proceedings of the Royal Society. It was mentioned a little earlier that there are numerous empirical formulae that are in general use in the trade. The formulae come out elegantly from the general solution as particular case."

Prof. Krishnan also cited some other results of mathematical interest arising out of these investigations on filaments. The problem of temperature distribution along a heated tube was also solved in collaboration with R. Sundaram and reported in the Royal Society Proceedings in 1960.

Dr. Krishnan then referred to his theoretical investigations with Dr. A. B. Bhatia, supported by the experimental work of A. C. Joshi, on the electrical conductivities of metals and alloys as his second major line of work.

"Adopting the well-known mathematical techniques one uses for the calculation of the diffuse scattering of X-rays in a crystal, the scattering of the Fermi electrons in the metal can be calculated in detail in different directions."

"In a binary alloy the contribution from the fluctuation in concentration to the resistivity of the alloy is found to be much larger than that from the fluctuations in density, thus accounting for the well-known large increase in resistance due to alloys. This simple method of approach is found to be very effective in the discussion of the electrical properties of metals and alloys, particularly of those which exhibit order disorder phenomena, and also the changes that take place in melting."

Dr. Krishnan refers to a result of interest to pure mathematics emerging out of these investigations as a typical example of the interdependence of the different branches of science.

"The classic investigations of Einstein on light scattering whose technique was adopted by Dr. Bhatia and me for the corresponding problem in electronic scattering" led to a significant result that the infinite series which determines the scattering coefficient is equivalent to the integral even when a is not small." An elegant proof was suggested by Prof. Norbert Wiener. "On the basis of Wiener's proof we have been able to construct a large class of funtions which have the same property. We could also construct several interesting series among which are some which appear prominently in one of Ramanujan's papers."

The third major line of investigations are his studies in collaboration with Dr. S. K. Roy "On the frequency and the anharmonicity of some of the modes of vibration of ionic crystals. The results appear in a series of papers in the Philosophical Magazine and in the Proceedings of the Royal Society."

The significance of these studies, in brief, are explained by Prof. Krishnan as follows :

"The calculated frequency is not the frequency of the principal mode of the crystal, but of the constituent oscillators, whose mutual influence has to be taken into account before obtaining the frequency of the normal mode of the crystal. This influence comes out to be just the effect of the well-known Lorentz polarization field; and the magnitude of the Lorentz factor is almost exactly verified. This is the only case known in which all the conditions postulated by Lorentz hold, and it is significant that this is the only case in which the factor is exactly verified."

"One gets from this an insight on the effect of the polarization field on the refractivities of dense media. The effect can be taken into account in two alternative ways, which are mathematically equivalent."

"One may regard it as affecting either the strength of the oscillator, without affecting its frequency, or the frequency of the oscillator without affecting its strength. This leads to the well-known dispersion formulae of Lorentz and Drude respectively, which express the refractivity as a function of frequency. It resolves a long standing controversy regarding the merits of the two formulae, and the solution happens to be a Pickwickian one, namely, that the two are mathematically equivalent, the frequencies that appear in the Lorentz formula being those of the constitutent oscillators, while those appearing in Drude are those of the medium. Many significant results follow therefrom."

In one of his numerous convocation addresses he has referred to three stages in scientific research. The first being a romantic stage, the second is "one of trying to find a simple and elegant pattern into which all the data can be fitted" the third being "one of generalization, when the researcher finds to his great satisfaction, that the ultimate pattern that he has formulated, not only fits well with his own observations, but can predict many new results, and can accommodate elegantly quite new sets of fact from entirely different fields. Nothing is so gratifying to a researcher than to find that the pattern which he formulated to fit his small area of experience has a much wider connotation. This is the stage when he can be much free than before, when he can afford not only to forget details, but even find it necessary to do so. It is the stage of maturity and wisdom as distinguished from mere knowledge as in the earlier stages." How well Prof. Krishnan fits into his own definition of a mature scientist.

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His decided preference for fundamental research has not prevented him from appreciating the contributions he himself has made to technology or the importance of applied research. In the Patel Memorial Lectures he raises this guery and answers it very emphatically by quoting Professor Alfred North

Whitehead, "a great mathematician and a great philosopher." In advocating a liberal education in the Universities of both humanities and the sciences he has all along emphasised the immense usefulness of technology. He says, "independently of its usefulness and purely for its educative value, the study of technology is superior to the other disciplines."

"Technical education is a marriage of the Platonic and Benedictine ideals which ensures the co-ordination between thought and action, which is essential for the development of personality."

"There can be no adequate technical education without its being liberal and no liberal education which is not technical. The intimate union of practice and theory aids both".

"Whether we like it or not we are in an age of science. If we are to be realistic, if our education is not to be divorced from our environments, if it is to harmonize with the actual life which you and I have to live, scientific and technical education should form an integral part of normal education for not only those who are likely to go in for a scientific or technological career, but for every one who aims acquiring a truly liberal education".

These are some of his refreshing views to the often times controversial questions on university education which has been exercising the minds of our educationists recently. As a member of the University Grants Commission he lent his powerful voice to the strengthening of the universities and has repeatedly emphasised that study of the humanities are just as important as the sciences. In fact, he advocates a study of sciences by all to acquire a really phiosophical outlook.

Dr. Krishnan, an Honorary Follow of the Institution of Telecommunication Engineers had an abiding interest in this field. He was the Chairman of the Radio Research Committee from 1950 and it was during his tenure that International Geophysical Year (1957-58) was organised in which India took active part in all the fourteen disciplines.

A special Volume of the Journal of Scientific Research was brought out on the occasion of Dr. Krishnan's 60th birthday which gave an account of the work carried out under the International Geophysical Year programme. Prof. Sydney Chapman, President, Special Committee for the IGY, has this to say of Prof. Krishnan's part in organising the IGY Programme in India.

"I would specially write of his association with that remarkable worldwide scientific enterprise—the International Geophysical Year (IGY) 1957-58. Only his colleagues on the National IGY Committee for India can fully know the leadership and the support he has given, as President of that Committee, in developing India's IGY participation and programme. But the scope and

excellence of that programme redounds to his credit, which he will be first to wish to share with his many distinguished fellow officers and colleagues on the Committee and with the still greater number of his countrymen and countrywomen who are taking a direct personal part in the programme."

"Sir K. S. Krishnan has not only led and supported the plans for India's share in the IGY, he has also given it valuable support on the international level, in his capacity as Vice-President of the International Council of Scientific Unions (ICSU) for the past six years. This eminent position has given him a voice in the formation and progress of the Special Committee for the International Geophysical Year (CSAGI)—Comité Special de l'Annee Geophysique Internationale—over which I have had the honour to preside. As a leading member of the Bureau of ICSU he has shared the executive responsibility resting on that Bureau for multitudinous scientific affairs associated with ICSU; and not least as regards the IGY and the reports by CSAGI to ICSU, his scientific knowledge and experience have fitted him to give counsel solidly based."

A symposium was organigsed at the end of 1960 when some ninety papers were presented. The data collected is quite voluminous and will take time to analyse and study but preliminary investigations indicate India's contribution, on a global basis, if not insignificant.

One of the major programmes was the global study of the Ionosphere. The Radio Research Committee under the Chairmanship of Prof. Krishnan, organised ionospheric studies from eleven stations which formed part of an equatorial chain along 75° E longitude,

India happens to be one of the few IGY countries through which the geomagnetic equator passes. Many geophysical events of particular significance occur near the equator, including the equatorial electrojet, and ionosphere cosmic ray and geomagnetic anomalies.

His active interest in the Telecommunications field was well recognised by his being invited to be the guest speaker at the International Telecommunication Union at Geneva. In his address he dwelt on the many contributions of physicists to Telecommunications and the close interdependence between contiguous disciplines.

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Prof. Krishnan has been the recipient of many honours both in India and abroad. He is a past President of Indian Science Congress, of the National Academy of Sciences and of the National Institute of Sciences. He is a founder member of the International Union of Pure and Applied Physics and of the International Council of Scientific Unions.

In 1955 the U. S. National Academy of Sciences invited Prof. Krishnan to be their chief guest at their annual meeting as the representative of Indian Science. This is an honour which has been previously given only to the

President of the Royal Society, London, the President of the Royal Netherlands Academy, and the President of the Swedish Academy. At the ceremonial dinner of the academy he sopke on India's forward outlook on science and Technology and also explained how that outlook was tempered by her own basic philosophy and sense of values. "You did much to emphasise and strengthen the friendly bonds between scientists of your country and ours, and thus fostered the traditional international Unity of Science."

Next year in 1956, Dr. Krishnan was elected a Foreign Associate of the National Academy of Sciences. This is a signal honour indeed as the total number of Foreign Associates today is only 60, of whom 9 are physicists. In the same year he was invited to deliver the second series of Sardar Vallabhbhai Patel Memorial Lectures, taking as his theme "The New Era in Science".

He was knighted in 1946. The Government of India in recognition of Dr. Krishnan's long and meritorious services to the cause of science and education honoured him with the title of Padma Bhushan in 1954 and later in 1958 appointed him a National Professor—an honour he shares with Prof. C. V. Raman and Prof. S. N. Bose.

His erudition and scholarship of Tamil classic, Sanskrit and Hindu religion is wellknown and many associates and learned societies sought him for discourses on the subjects. His scientific publications in the Proceedings of the Royal Philosophical Magazine, Nature, Physical Review and Journals of that class total to more than 130.

In closing it is quite apt to quote from the Prime Minister's speech on Prof. Krishnan's 60th birthday which sums up what all his friends, colleagues, associates, students and public at large thought of him.

"Apparently some good fairy visited Dr. Krishnan on the day of his emergence into this world and gave him these many qualities—if you like many advantages which he developed and here he is, a great scientist, great in many ways, a great scholar and a man who, least of anybody I know is lopsided in science so much that he forgets the other aspects in the humanities in scholarship, in other ways, in his love of music and so many other things. Here is a man with so many facets and above all something to which reference has been made that he has not lost that essential gentleness and humanity which goes with true greatness and lastly that he is a man who enjoys life and his work and that is the greatest blessings of all for himself and others."

Is it any wonder many feel a sense of personal loss?

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- 113. The Thermionic Constants of Metals and Semiconductors II Metals of the First Transition Group (with S. C. Jain), Proc. Roy. Soc. A, Vol. 215-431 (1952).
- 114. The Polarisation fields and the Resonance Frequencies of the Alkali Halide Crystals : (with Sanat Kumar Roy) The Phil. Mag. Vol. 44, pp. 19-32 (1253).
- 115. The Temperature Variation of the Thermodynamic Potential of a Degenerate Electron Gas: (with P. G. Klemenes) The Phil. Mag. Vol. 43, pp. 1224 and 1225 (1952).
- 116. Thermionic Constants of Metals Determined by a New Method (with S. C. Jain) Paper Read at the URSI General Assembly at Sydney (August 1952).

- 117. Thermionic Constants of Metals and Semiconductors-III. Monovalent Metals (with S. C. Jain) Proc. Roy. Soc., A, Vol. 217, p. 451 (1953).
- Temperature Distribution along a Wire Electrically Heated in Vacuo: (with S. C. Jain) Nature, Vol. 173, p. 166 (1954).
- The Distribution of Temperature along a thin rod Electrically Heated in Vacuo: (with S. C. Jain) I Theoretical. Proc. Roy. Soc. A, Vol. 222, pp. 167-180 (1954).
- Temperature Distribution in a Electrically Heated Filament (with S. C. Jain) Nature, Vol. 173, p. 820 (1954).
- 121. The Distribution of Temperature along a thin rod Electrically Heated in Vacuo II. Theoretical (continued) with S. C. Jain. Proc. Roy. Soc. A, Vol. 225, pp. 1-7 (1954).
- 122. The Distribution of Temperature along a thin rod Electrically Heated in Vacuo III. Experimental (with S. C. Jain) Proc. Roy. Soc. A, Vol. 225, pp. 7-18 (1954).
- 123. The Distribution of Temperature along a thin rod Electrically Heated in Vacuo-IV. Many useful Empirical Formulae Verified: (with S. C. Jain) Proc. Roy. Soc. A, Vol. 225, pp. 19-32 (1954).
- 124. Thermionic Constants of Metals and Semiconductors IV. Monovalent Metal (continued) (with S. C. Jain) Proc. Roy. Soc. A, Vol. 225, pp. 159-172 (1954).
- 125. Determination of Thermal Conductivities at High Temperatures (with S. C. Jain) Brit. J. Appl. Phys. 5, No 12, 426-30 (Dec, 1954).
- 126. The Distribution of Temperature along a thin rod Electrically Heated in Vacuo V. Time Lag (with S. C. Jain) Proc. Roy. Soc. A, 227, 141-54, (Jan 7, 1955).
- 127. The Distribution of Temperature along a thin rod Electrically Heated, in Vacuo VI. End-Losses (with S. C. Jain) Proc. Roy. Soc. A, 229, 439-45 (May 24, 1955).
- Thermionic Constants of Semiconductors (with Jain) Nature (London), Vol. 177, 285 (Feb. 11, 1956).
- 129. The Drude Dispersion Formula Shown to be Applicable to any Modium Irrespective of the Polarization field (with S. K. Roy) Phil. Mag. (Eighthser), Vol. 1, 926-33. (Oct, 1956).
- Radiative Transfer of Energy in the core of a Heated Tube (with R. Sundaram) Nature (London) 188, 483-484, (Nov. 5, 1960).
- 131. The Distribution of Temperature along Electrically Heated Tubes and Coils. I. Theoretical (with R. Sundaram) Proc. Roy. Soc. A, 257, 302-315 (1960).
- Quenching of Cation Vacancies in Doped Crystals of Sodium Chloride (with Jain) Nature (London), Vol. 191, pp. 162-163 (1961).
- 133. Thermionic Properties of Monovalent Metals Presented by (Dr K. S. Krishnan) at the Hague Meeting of the VUSI in Commission VII, September Proc. p. 136, (1954).
- 134. The Polarization Field in an Ionic Crystal and its Influence on the Reststrahlen Frequency by (Sir K. S. Krishnan and Sanat Kumar Roy)—Read at the Symposium on Physics of Solid State, held during the Silver Jubilee Session of the National Academy of Sciences at the University of Lucknow, on December 27th, Proc. Nat. Acad. of Sciences (India) Allahabad, Vol. 25, A, pp. 50-57 (1955).
- 135. The New Era of Science (Sardar Vallabhbhai Patel Lectures) by (Sir K, S. Krishnan) The Publications Division, Government of India (Oct. 1956).
- 136. Effect of Specular Reflections on the Radiation Flux from a Heated Tube by Nature, Vol. 187, 135, (July 9, 1960).
- 137. Some Aspects of the Scientific Background to Telecommunications, Telecommunication Journal No. 8, (August 1960) (Address as Guest Speaker at the International Telecommunication Banquet, Geneva, (Nov. 1959).
15. REVIEW OF PROGRESS :

It was reported in the last year's annual report that the Council formed a Sub-Committee to consider in detail the interesting suggestion made by Lt. Col. J. N. Shahani in regard to stock-taking of the achievements of the Institution during its existence over the last eight years and to help in formulating a clear objective for the future. The Sub-Committee consisted of the following members :

> Shri C. P. Vasudevan Shri N. V. Gadadhar Shri K. R. K. Iyengar (Alternate) Shri S. N. Mitra Brig. B. J. Shahaney Lt. Col. J. N. Shahani

The Sub-Committee has met on 25th November 1961 and has considered some of the aspects of the problems. A brief report of the preliminary findings of the Committee on some aspects is given below. The sub-committee is yet to continue its work and consider other aspects of the problem. The full report of the Sub-Committee will be published when its deliberations are over.

The members discussed the various points mentioned in the letter from Lt. Col. J. N. Shahani and his *aide-de-memoire*. The members generally appreciated the various suggestions contained in the letter and the *aide-de-memoire* and took up for consideration the Graduateship Examination of the Institution in this meeting.

The percentage of Student members that were successful in passing the Graduateship Examination during the previous years were extremely low. It was also distressing to find that a large number of student members had discontinued membership and the figures of such discontinuation are as high as 355 members against the increase of 735 during the period. The exact reasons for such large exodus of student members cannot be easily ascertained. It may be that these student members have not been able to pass the examination after repeated attempts. It is also possible that they were unable to sit for the examination as they had no proper training facilities and suitable books covering the syllabus at a reasonable price for their preparation. However, with a view to giving them maximum encouragement, training facilities and other benefits to the Student members of the Institution, it is desirable to consider the various aspects in the system of our examination and devise suitable ways and means by which proper guidance and facilities can be offered. This will not only help the individuals and further the cause of the Institution but also by their success at the examination will, by and large, meet the existing shortage of telecommunication engineers in the country and help India's developmental plans. After detailed discussions it was agreed that immediate steps should be taken by the Institution to consider the following aspects of the examination by which the percentage of pass can be increased.

(a) **Syllabus**: The syllabus of the Graduateship Examination was prepared quite a few years ago when the Institution had no experience of the exact scope and the extent of such examinations. Since then a large number of technological Institutions have come up in India both from private and public enterprises where telecommunication engineering is being taught either as a special subject or a subsidiary one. It was, therefore, felt that the

syllabus of the Institution should be suitably revised. Although it is not expedient to make drastic changes in the syllabus, it will be in the interest of the profession of telecommunication engineering to re-orient the syllabus in such a manner as is best suited to the needs of the country to-day. The Sub-Committee therefore, recommended that immediate steps be taken to have the syllabus scrutinised by the small group of members already authorised to do so by the Council.

(b) Books : The student members of the Institution do not have the opportunity of attending regular classes in a university for obtaining their degrees and are generally of low income groups. Thus, since they are denied the facility of lecture notes, they will have to depend on standard text books for preparing for their examinations. It was felt, therefore, that some action should be taken by which standard text books could be made available to the student members at a reasonable rate. The books written by foreign authors are to-day the standard ones but since they are extremely costly it is difficult for all the student members to purchase them. If, therefore, such books can be written in India and be made available at a reasonable cost it will not only help the student members of the Institution of Telecommunication Engineers but perhaps will be equally useful to all undergraduate students preparing for B. E. (Telecommunications) or equivalent degree examinations. Such books will necessarily be a compilation work and not an original one. A scheme should be sponsored by the Institution for requesting a susbidy from the Ministry of S. R. & C. A. or the Ministry of Education to enable a panel of writers to write standard text books on the various subjects of the Graduateship Examination. If such an assignment can be properly carried out by the Institution the effort will go a long way in solving one of the most acute problems in technical education to-day, namely, availability of text-books at reasonable price. If the suggestion is approved by the Council a suitable Sub-Committee may be formed to examine in detail the extent of work involved and draw out concrete schemes.

(c) Model Answers: Since most of the student members have no opportunity to prepare for answering questions for a degree examination, they need proper guidance as to how best to answer a question effectively and in shortest possible time. It has been the aim of the Institution to publish model answers to some questions in the Students' Quarterly for the benefit of the student members. There have, however, been difficulties in obtaining such model answers from the examiners. The response from the examiners has been extremely poor and it is doubtful whether an appropriate number of model answers can be obtained for publication. The Committee, therefore, felt that a small panel may be formed who would be requested to prepare model answers to the various questions in the Graduateship examination of the Institution so that such answers can be published in the form of a booklet just as it is the practice in British Post Office, City and Guilds, Institution of Electrical Engineers etc. Such answer books can be made available at a low cost to those who are interested and suitable honorarium may be given to the persons preparing such model answers.

16. STAFF AND ACCOMMODATION :

The accommodation of the Institution remains the same at 9/B, Bazar Marg, New Delhi. The staff of the secretariat consists of the following

Assistant Secretary	1	Typist-clerks	3
Technical Superintendent	1	Accounts Clerk	1
Stenographer	1	Peons	2
Stenotypist	1	a series and the series of the	

The above staff includes the following additional posts created during the year to cope up with increased activities of the Institution specially for the membership and examination of the Institution.

Technical Superintendent1Typist-Clerks2Peon1

A post of librarian has been created during the year and will be filled during next year.

17. BUILDING :

The construction of a building for the Institution has been receiving the attention of the members of the Council for quite sometime. The Institution's reserve funds are approximately Rs. 1 lakh and if suitable grant to supplement the cost of a building is available from the Government it would be possible to have a building of the Institution in the foreseeable future. An appeal was made to the Ministry of Works, Housing & Supplies to allot a plot of about one acre of land at a suitable place for constructing the building for the Institution. The President and the Secretary of the Institution met the Deputy Minister for Housing and impressed upon him the urgent need for a building of the Institution. Negotiations are still going on with the Ministry of Works, Housing & Supplies for the allotment of a plot. Meanwhile another appeal has been made to the Ministry of S. R. & C. A. for a grant of Rs. 7 lakhs to the Institution for the construction of a building since the Reserve Fund of approximately I lakh is inadequate for the purpose. This is engaging the attention of the Ministry of S. R. & C. A.

The Institution of Town Planners has been considering a proposal to construct a multi-storeyed building on Ring Road in the Indraprastha Estate. The President of the Institution was approached whether our Institution would like to have any accommodation in the proposed building and if so whether the Institution was prepared to share the cost of construction. The matter was discussed in the Council and it was decided to explore the possibility of having three floors in the proposed multi-storeyed building for housing the Institution, the cost of these three floors being borne by the Institution. It is now understood that the Institution of Town Planners has approached the Ministry of S. R. & C. A. for a suitable grant for constructing a multi-The Ministry of S. R. & C. A. have asked our storeyed building. Institution to provide details of the requirements so that the appropriate grant towards the cost of construction could be considered. Negotiations are in progress with the Ministry of S. R. C. & A. and the Institution of Town Planners, for having three floors in the proposed multi-storeyed building. If this proposal comes through, the Institution can have a suitable accommodation of its own much sooner than as otherwise anticipated.

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18. INDIAN PARLIAMENTARY AND SCIENTIFIC COMMITTEE :

We announced in the last year's Annual Report that an event of major importance to science and the nation took place on 27th August 1961 when the Indian Parliamentary and Scientific Committee was inaugurated by the Prime Minister. Our Institution has joined this Committee as a Member and has nominated two persons to attend its General Committee meetings and its Annual meetings. The objectives of the Parliamentary and Scientific Committee have already been given in the last year's Annual Report.

The First General Committee Meeting was held between 3rd and 5th September 1962 at the Parliament House, New Delhi. The Honorary Secretary represented the Institution at the General Committee Meetings and attended all the sessions.

The Committee has as its President Shri Jawaharlal Nehru, Prime Minister of India and as Chairman Shri Lal Bahadur Shastri, Home Minister. The Executive Committee consists of the following office bearers:

I.	Prof. Humayun Kabir	Vice-President
2.	Shri T. N. Singh	32
3.	Dr. A. N. Khosla	23
4,	Shri C. R. Pattabhi Raman	
5.	Prof. Hiren Mukherji	32
6.	Shri Ganga Sharan Sinha	55 1
7.	Dr. D. S. Kothari	23
8.	Shri M. K. Ghosh	29
9.	Shri S. K. Patil	—Treasurer
10.	Maj. Gen. Harkirat Singh	-Representing the Institution of
	the second s	Engineers (India).
11.	Dr. K. Banerjee	-Representing the Indian Association
		for Cultivation of Science.
12.	Dr. C. S. Patel	-Representing the Medical Council
		of India.
13.	Shri R. P. N. Sinha	Secretary
14.	Shri H. C. Dasappa	>>
15.	Shri Krishan Kant	37

It was decided then to form four Sub-Committees to study the following subjects :

- 1. Science, Technology and Industry
- 2. Science and Agriculture
- 3. Science and Medicine
- 4, Scientific Education and Research.

As an adjunct to the inaugural meeting a seminar on "Place of Science in Secondary Education" was held under the presidency of Shri Lal Bahadur Shastri on 29th August 1961 in which Dr. D. S. Kothari, Dr. A. C. Joshi and Dr. K. P. Basu participated. Prof. Humayun Kabir, in proposing a vote of thanks, expressed his views on the subject. The Institution has submitted a paper on the subject and was duly reported in the last Annual Report of the Institution.

Meetings :

Executive Committee: The meetings of the Executive Committee were held on 11th May 1962 and 3rd September 1962.

Meetings of the Study Groups : Three Study groups relating to the following subjects were formed,

- (i) Science in Secondary Education.
- (ii) Population Control and Family Planning.
- (iii) Responsibilities of Scientists for the Survey, Planning, Design and Development of Industries in India.

One feature of these study groups is that apart from Members of Parliament interested in the particular subject, Members of Planning Commission, experts of the concerned Ministries, Scientists in the field are also participating in them and contributing greatly to the discussions.

The first study group on 'Science in Secondary Education' met in November 1961, on 11th May 1962, 4th June 1962, 22nd August 1962 and 31st August 1962. Certain decisions have been taken and the group is now engaged in bringing out a report which may be ready to be released during the winter session of the Parliament.

The second study group on Population Control and Family Planning met three times on 30th May 1962, 31st May 1962 and 1st June 1962 and the results of discussion are in the process of being embodied in a report.

The third study group on the Responsibility of Scientists for the Survey, Planning, Design and Development of Industries in India met for the first time on 25th August 1962. The subject that was taken up for discussion was the need for developing consultancy agencies within the country.

The Executive Committee has decided to bring out a publication "Science in Parliament" which will be a quarterly, dealing with matters pertaining to questions and discussions on science in Parliament and useful contributions on scientific subjects. It is considered very desirable and necessary to have a science corner somewhere in the periphery of the Central Hall or a room near enough to it.

The various sessions in the first General Committee meeting of the Indian Parliamentary and Scientific Committee are given below:

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Monday, the 3rd September 1962 :

9.30 to 11.00 a.m.—Sub-Committee on "Science and Industry" Room No. 53, Parliament House.

12.30 to 1.30 p.m .-- Executive Committee Meeting.

5.05 p.m.

-Immediately after the Parliament rises-General Committee Meeting in the Central Hall of Parliament House.

Chairman: Shri Lal Bahadur Shastri to preside. Seminar on "Flood Problems of India"

Inauguration by Hon'ble Speaker, Sardar Hukum Singh.

Participants : Dr. A. N. Khosla (Planning Commission) Shri P. R. Ahuja (C. W. P. C.) Shri R. D. Dhir (C. W. P. C.)

Shri Bhanj Deo (Ex-Minister of Orissa).

Tuesday, the 4th September 1962 :

9.45 to 11.00 a.m.—Sub-Committee on "Science and Agriculture" Room No. 53, Parliament House.

12.15 to 1.30 p.m.-Sub-Committee on "Scientific Education and Research." Room No. 53, Parliament House.

5.05 p.m. —Immediately after the Parliament rises : General Committee Meeting in the Central Hall of Parliament House.

> Chairman : Shri Lal Bahadur Shastri to preside. Continuation of the Seminar on "Flood Problems of India."

Wednesday, the 5th September 1962 :

12.15 to 1.30 p.m.-Sub-Committee on "Science and Medicine" Room No 53, Parliament House.

The Council of the Institution received a request from the Secretary of the Indian Parliamentary and Scientific Committee for submitting a paper on "The Impact of Scientific Research on National Economy." The Council has requested Shri N. V. Gadadhar, Wireless Adviser to the Government of India for preparing a paper for submission to the Indian Parliamentary & Scientific Committee.

19. STATEMENTS OF ACCOUNTS :

The Audited Statement of Income and Expenditure for the year ending 30th September 1962 and the Balance Sheet as on 30th September 1962 are given in the following pages :

The Institution of Telecommunication Engineers NEW DELHI

ACCOUNTS FOR THE YEAR ENDED 30th SEPTEMBER-1962

Report of the Auditors to the Members

We have examined the enclosed Balance Sheet of the Institution of Telecommunication Engineers, New Delhi as at the 30th day of September 1962 and also the accompanying Income and Expenditure Account for the year ended on the said date in which are incorporated the returns of the centres certified by the persons in charge and have to report as follows:

1. In a number of cases, the membership fee from new members has not been charged in accordance with the Byelaw 26 of the Institution's Bye-laws.

2. Registration fee of Rs. 6/- per application for membership is being charged in accordance with a Council decision, we feel before such an amount can be charged the bye-laws need to be amended as per Articale 17 of the Institution's Articles of Association.

3. The funds relating to the Staff Provident Fund were not audited by us.

4. The accounts have been properly drawn up and we have obtained necessary information and explanations required.

5. The Balance Sheet exhibits a true and correct view of the state of the affairs of the Institution subject to our remarks above.

28th November, 1962. B7/III, Asaf Ali Road, New Delhi-1 Khanna & Annadhanam Chartered Accountants

The Institution of Telecommunication

Balance	Sheet	as	at	

30.9.1961	LIABILITIES	Rs. nP.	Rs. nP.
Rs.	Surplus Fund :		
56,442	Balance as per last Balance Sheet	70,016.70	
	Add : Excess of Income over Expen-		
13 534	diture for year as per annexed	12 106 70	82 123 40
13,374	account	12,100.19	04,143.47
70,010	and the second se		
10.000	Reserve Fund :	FO 040 (0	
40,951	Balance as per last Balance Sheet	50,840.62	
9 374	Add: (i) Admission Fees 15 400 00		
516	(ii) Transfer Fees 920.00	16,320.00	67,160.62
50,841			
	GRANT IN AID FROM THE GOVERNMENT		
	OF INDIA FOR LIBRARY		50,000.00
	Reserve for Bad Debis :	1.20	
1,106	Balance as per last Balance Sheet	1,282.50	
4,000	Add: Provision for the year	10,000.00	
	Amount written off in		
805	during the year	898.00	
5.911	builing the your	12,180.50	
	Less : Amount written off during		
4,628	the year	5,076.00	7,104.50
1,283			
1	Liabilities :	1 (01.01	
1,544	Members at Credit	1,684.34	
4 443	Journal Subscription received in Advance	7 872 26	
501	Admission Fee received in Advance	212.00	
97	Suspense	451.45	
208	Staff Deposit	.449.00	
13,563	Examination Fees received in Advance	39,920.50	
344	Advertisers at Cradit	408.13	53 989 95
	Auvelusers at Creuit	C1+00+15	55,707.75
1,45,120		Rs.	2,60,378.56

Auditor's Report

As per our Report to the Members attached separately

November 28, 1962. Asaf Ali Road, New Delhi Sd./ Khanna & Annadhanam Chartered Accountants

Engineers, New Delhi

30th September, 1962

30.9.1961	ASSETS	Rs. nP.	Rs. nP.
Rs.	Fixed Assets :		
6,890	As per Schedule attached		22,236.45
	Current Assets :		
	Stock at cost as certified		
1 201	by the Assistant Secretary :		
617	Papers 235.73	371 48	
A 179	Due from Mombars for For	10 603 50	A LONG TO ALL
396	Due for Journal Subscription	428.06	
	Due for Journal Advertisement :	100100	
	Institute Journal 4.258.65		
4,840	Students' Journal 359.13	4,617.78	
982	Interest Receivable	2,799.73	18,910.55
12,924			
	Cash & Bank Balances :		
263	Cash in hand	201.26	
19	Postage in hand	16.00	
712	Imprest with Local Centres	690.57	
	(as certified by Hony. Secretary)		
0000	Cash with Banks :		
95,000	On Fixed Deposits	1,35,500.00	
	Central Bank of India Ltd		
671	Bangalore	1.243.44	
	Central Bank of India Ltd.		
10 010	New Delhi	40,948.90	
18,540	Bank of Baroda Ltd.		
10,101	Bank of Baroda Ltd., New Delhi	40,631.39	2,19,231.56
1,25,306			

1,45,120	Rs. 2,60,378.56
Sd/- Lal C. Verman	Sd/- S. N. Mitra
President	Hony. Secretary
Sd/- C. P. Vasudevan	Sd/- K. R. K. Iyengar
Vice-President	Hony. Joint Secretary

The Institution of Telecommunication Income & Expenditure Account for the

30.9.1961			
Rs.		Rs. nP	. Rs. nP.
15,898 7,644 2,873 2,642 656 1,918 322 250	To ESTABLISHMENT "Medical Aid to Staff" "Rent & Electricity "Printing & Stationery "Postage & Telegrams "Telephone Charges "Sundry Expenses (Net) "Bank Charges (Net) "Audit Fees		22,896.99 318.07 7,978.25 4,020.59 3,886.28 596.60 2,979.10 154.74 500.00
	" Institute's Journal Expenses :		
15,646	Cost of Paper	4,209.62	
	Printing Charges	9,690.29	
2,855	Block Making Charge	3,434.85	
1,860	Postage & Packing	1,973.39	20 520 59
1,205	Keprints Cost	1,222.43	20,330.38
21,566			
	" Students' Journal Expenses :		
-	Cost of Paper	1,202.24	ļ
4,200	Printing Charges	4,357.07	
562	Block Making Charges	845.51	
643	Postage & Packing	1,331.69	
301	Reprints Cost	336.41	0.400.00
350	Honorarium	350.00	8,422.92
6,056			
289	" Binding Charges		116.25
8,300	" Examination Expenses		11,192.02
460	", Depreciation		776.13
4,000	" Provision for Bad Debts		10,000.00
-	" Employers' Contribution to		000 (1
141	Provident Fund		938.64
300	" Local Centre Expenses		259.06
2 107	1, I. I. E. AWAIU Annual General Meeting Experses (Net)		1 609 22
Leg 101	Excess of Income over Expenditure		4,000.33
	for the year Transferred to		
13,574	Surplus Fund		12,106.79
		arran	
90,102			Rs. 1,12,781.34

Engineers, New Delhi

Year Ended 30th September, 1962

30.9.1961			
Rs.		Rs. nP	Rs. nP.
44,450	By Membership Fees		54,988.00
1,570	" Sale of Institute Publications		2,027.75
	" Income from Institute's Journals :	•	
5,996 12,636 953 19,585	Subscriptions Advertisements Sale of Reprints	4,410.91 7,512.29 1,093.72	13,016.92
	" Income for Students' Journal :		
	Subscription Advertisement	598.32 641.77	1,240.09
18,599	" Examination Fees		33,862.00
3,737	,, Interest		5,200.58
746	" Registration Fees		1,511.00
220	" Life Membership Fee		
1,195	" Registration Charges Forfeited		935.00

90,102

Rs. 1,12,781.34

28th November, 1962 Asaf Ali Road, New Delhi Khanna & Annadhanam Chartered Accountants

The Institution of Telecommunication Engineers, New Delhi

Schedule of Fixed Assets Accompanying and forming part of the Balance Sheet on 30th September, 1962

	Cost or Book value as on 30,9,1961,	Additions during the year	Total cost or Book value as on 30.9,1962.	Written off upto 30.9,1961	Written off during the year	Total Deprecia- tion	Net value of Assets as on 30.9.1962.
1. Typewriters	1,961.06	1,917.90	3,878,96	833,52	189.19	1,022.71	2,856.25
2, Duplicating Machine	1,525.75		1,525,75	755,16	77,00	832,16	693,59
3. Adrema Machine	1,003.28		1,003,28	496,04	50,72	546,76	456,52
4. Furniture	2,959.03	2,387.20	5,346.23	473.97	235,06	709.03	4,637,20
5. Cycle	279.50		279,50	232,59	9,38	241,97	37,53
6. Numbering Machine	45,62		45,62	18.10	1,65	19.75	25,87
7. Electric Fans	950,80	175.32	1,126.12	63,50	97,49	160,99	965,13
8. Library	1,075.44	11,642.19	12,717.63	37,63	115.64	153,27	12,564,36
Rs	. 9,800,48	16,122.61	25,923.09	2,910,51	776.13	3,686.64	22,236.45
Last year's Figures	6,275.00	3,525.00	9,800.00	2,450.00	460,00	2,910,00	6,890.00

Asaf Ali Road, 'New Delhi

November 28, 1962

Sd/- Khanna & Annadhanam Chartered Accountants

PART-II

1. LIST OF HONORARY FELLOWS AND FELLOWS **OF THE INSTITUTION :**

Honorary Fellows :

Honorary Fellows of the Institution are distinguished persons in their own fields and their names are given below :

ishnan, S., D. Litt. (Agra), D. Litt. (Allahabad), D. Litt. (Andhra), D. Litt. (Annamalai), L. L. D. (Banaras Hindu Univ.), D. L. (Cal.), L. L. D. (Jabalpur), D. Litt. (Lucknow), L. L. D. (Madras), L. L. D. (Mysore), L. L. D. (Osmania), D. Litt. (Patna), D. Sc. (Roorkee), D. Litt. (Saugar), D. Litt. (Visvabharathi). Radhakrishnan, S., D. Litt.

Foreign Universities : L. L. D. (Bagota), L. L. D. (Brussels), L. L. D. (Buenos Aires), D. Litt. (Cambridge), L. L. D. (Ceylon), L. L. D. (Columbia, U. S. A.), L. L. D. (Hawaii Univ.), L.L. D. (Howard), L. L. D. (London), L. L. D. (Maing), L. L. D. (McGill Canada), L. L. D. (Mexico), L. L. D. (Oberlin, U. S. A.), D. C. L. (Oxford), L. L. D. (Prague), L. L. D. (Rome), L. L. D. (Sofia Univ.), L. L. D. (Wroslaw).

Other Distinctions : Vidyachakravarti-Kelaniya Parivina, Fellow of the British Academy, Other Distinctions : Vidyachakravari-Keianiya Pariwina, Fellow of the British Academy, Pour Le merite-Germany, Hony. Fellow of the Academy of Sciences of the Republic of Rumania, Hony. Fellow of the Academy of Sciences of the Republic of Mongolia, Hony. Professor-University of Moscow, Professor Emeritus Calcutta University, Professor Emeritus Oxford University, Honorary Fellow of All Souls College Oxford, Sarvagama Sarvabhuma-Calcutta Sanskrit College, Goethe Plaque, Master of Wisdom Mongolia, German Book-sellers Peace Prize-1961, Wlodzimicrz Pietrzak Prize by Warsaw University for Philoso-phical Science. Bhoratobhusamani, Lactinuta of Ladology. Duracha phical Science, Bharatabhusamani-Institute of Indology, Dwaraka. President of the Republic of India, New Delhi.

Sir Edward Appleton, G. B. E., K. C. B., F. R. S., Nobel Laureate, Principal & Vice-Chancellor of Edinburgh Univ., The Old College, South Bridge, Edinburgh-8.

Kantabet, S. R., Retired Director General, Overseas Communications Service, Bombay.

Kothari, D. S., M. Sc., Ph. D., F. N. I.; Chairman, Univ. Grants Commission, Rafi Marg, New Delhi.

Mitra, S. K., D. Sc., F. R. S., F. N. I., Emeritus Professor of Physics, Calcutta University and National Research Professor, Institute of Radio Physics and Electronics, 92, Acharya Prafulla Chandra Road, Calcutta-9.

Thacker, M. S., D.Sc. (Hc), D.Litt (Hc), B. Sc. (Engg.), M. I. E. E. (Lond.), M. I. M. (Lond.), M. Inst. F. (Lond.), M. I. E., M. I. R. E., M. Ind, I.M.M. Ele. Chem. S., F. Am. I. E. E., F. I. A. Sc.. Secretary and Educational Adviser (Technical) to the Government of India, Ministry of Scientific Research and Cultural Affairs. and Director General, Council of Scientific and Industrial Research, Rafi Marg, New Delhi-2.

Fellows :

The Fellows of the Institution elected by the Council so far are as follows :

Year of Election	The frunction of the second se		Service on Council
1962	Agerwala, P. M., C. E. (Hons.), Member (Telecom. Operation), Posts & Telegraphs, P. & T. Die., New Delhi.	V. F	1955-57 2. 1957-58 2. 1958-59 1959-
1962	Aiya, S. V. Chandrasekhar (Prof.), M. A. (Cantab), M. I. E. E. (Lond.), Head of the Department of Electrical	V. F	1953-57

Communication Engg., Indian Institute of Science,

-57 -69 P. 1959-60 1960.

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Bangalore.

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Year of Election		S	Service on Council
1962	Baliga, B. V., B. A., D. I, I. Sc., Managing Director, Bharat Electronics Ltd., Jalahali, Bangalore.	V. P. P.	1953-57 1957-58 1959-
1956	Batra, B. R., C/o. The Associated Industrial Development Co. Ltd., 1 & 2 NICCO House, Hare Street, Calcutta-1.	Ρ.	1953-55 1955-59
1959	 Iyappa, A. C. (Maj. Gen.), Dy. Master General of Defence Ordnances, Ministry of Defence, New Delhi. Rakshit, H. (Prof.), D. Sc., F. Inst. P., F. N. I., Head of the 	V. P. P.	1953-55 1955-56 1956-62
	Department of Electronic & Electrical Communication Engg., Indian Institute of Technology, Kharagpur, West Bengal.		
1962	Sarwate, M. B., Ph. D., D. I. I. Sc., Asst. Director General, Interna- tional Telecommunication Union, Geneva.		1958-59 1959-60
1959	Sreenivasan, K. (Prof.), B.Sc., D.I.I.Sc., M.I.E.E. (Lond.), M.A., I.E.E., S. M. I. R. E., F. I. A. S., Director, Madras Institute of Technology, Chromepet, Madras.	V. P. P.	1953-56 1956-57 1957-61
1962	Vasudevan, C. P., B.E., Director, Telecommunication Research Centre, Posts & Telegraphs, P & T Dte., New Delhi.	V. P.	1955-58 1959-60 1960-62
1962	Verman, Lal C., B. S. (Engg. Michigan), M. S., Ph. D., (Cornell), F. Inst. P., M. I. E., F.N.I., Director, Indian Standards Institu- tion, Honorary Adviser to Government of India on Standardi- zation, Manak Bhawan, 9, Mathura Road, New Delhi.	V. P. V. P. P.	1953- 1956-58 1959-60 1960-62

2. LIST OF MEMBERS OF THE INSTITUTION :

The Total Number of Members of the Institution is 39 and they are as follows :

Year of Election	Service on Council	Year of Servic Election Count	ce on ncil
1962 Agerwala, S. M., B. So., Secretary, Telephone Switching System Com- mittee. P & T Dte., New Delhi.	1957-58 J.S. 1958-59 1959-60	 1955 Chakravarti, S. P., M.Sc. (Phys.), M. 195 Sc. (Engg.), M.I.E.E., D.I.C., Sen. V.P.195 MIRE, Fellow A. Sc. (Bangalore), 195 	3-57 7-58 8-61
1962 Batra, R. N., (Maj. Gen.), Director of Signals, Sig. Directorate, Army Headquarters, New Delhi	1953-56	M.I.E. Director, W.E.G., Ministry of Defence, Research and Develop- ment Organization, Room No.235-	
1955 Bhashyam, S. R., B. E. (Hons.), Sr. Member I. R. E. (New York), O. S.		E, South Block, Central Sectt., New Delhi.	
D., Room No. 520, 4th Floor P&1 Directorate, New Delhi 1955 Bhatt, N. B., (Dr.), M.Sc., D.I.I.Sc.,	1953-55	1962 Chaman Lat, M.Sc.(Phys.), Dy. Chief Engineer, All India Radio, New Delhi.	
Sc.D. (Mass), Officer-in-charge, Re- search & Development Orgn., Solid State Physics Labs., Lucknow Rd., Delhi		1955 Cornelius, C. A., B. Sc. (Engg.), Gen. Manager, Cal. Telephones, Telephone Bhavan, 34 Dalhousie Square, Calcutta.	

Year of Election	Service on Council	Year of Election	Service on Council
1958 Gadadhar, N. V., B.E. (Elec.), D:I.I. Sc., Wireless Adviser to the Govt. of India, Ministry of Transport & Communications, Block No. 2, Brassey Avenue, New Delhi.	S. 1956-58 S. 1958-59 T. 1960-	 1955 Ramamurthi, T. V., B.E. (Elec. I.Sc., Officer on Special Duty tional Physical Laboratory, side Road, New Delhi. 1955 Ramchandani, A. C., B.Sc. (), D.I. 1959-60 7, Na- J.S. 1960-62 , Hill- Engg. 1953-56
1962 Gupta, I. K., B. Sc., C. E. (Hons.), Manager, Bombay Telephones WK SP., Gill St., Jacob Circle, Bombay		Manchester), M.I.E.E., A.M Chief Engineer, All India New Delhi.	I.C.T., 1957-58 Radio, V.P.1958-60 V.P.1961-
1955 Jagadesh Prasad, C. E. (Hons.), Member (Tele. Com. Dev.) Posts & Telegraphs, New Delhi.	1955-56 1957-60 1961-	1959 Rao, B. V., Director (Retd.) seas Comm. Service, Calcutt 1959 Rao, C. R., M.Sc., D.I.I.Sc	, Over- a. ., Chief 1956-57
1955 Joseph, K. A, (Air Commodore), B.Sc. (Engg.). Director of Signals, Air Head Qrs., New Delhi.	1953-57 V.P.1958-61	International Civil Aviation nisation, Djakarta, Indonesi 1957 Rao, V. V. L., (Prof.), B. E., D. I. C. (Lond.), Dip. M. S.	Orga- T. 1957-39 a. (Elec.), 1953-55 . W. ² C.
1955 Kanjilal, S. K., B. E., Managing Di- rector, Indian Telephone Industries Ltd., Duravani Nagar, Bangalore.	1955-57 1958-59 T. 1959-60 1960-61	 (Chelms.), Principal, Col Engg., Ananthapur, A. P. 1955 Rau, B. S., B. E. (Elec.), Ma Director, Hindustan Tele 	lege of anaging 1955-56 eprinter T. 1956-57
1955 Kapre, P. K., (Dr.), M. Sc., Ph.D. (Lond.), Engg., A.M.I.E.E., D.I.C. (Lond.), M. I. E., M. I. M., B.L., Industrial Director, Philips India Limited, 3/1, Asaf Ali Road, New	1956-59 V. P .1960-	Ltd., Madras. 1962 Sarwate, V. V., B. Sc., M.Sc. less), Dip. I. I. Sc., M. S. Comm.), 1968 Wright Tow alpur.	1959-62 (Wire- (Elec. n, Jab-
Delhi. 1957 Lakhanpal, D. D., B. A., B.Sc. (Elec. Engg.), Director, Murphy Radio	1953-56 V.P.1956-57	1955 Sastry, M. L., B.Sc. (Engg.), E. E., Additional Chief En All India Radio, New Delh	A.M.I. 1956-59 11.
of India Ltd., 29 New Queen's Rd. Bombay-4.	1960-	1955 Sengupta, N. K., B.Sc. (Engg naging Director, Hindustan), Ma- Cables
1955 Mahaingam, N., B.A., A. M. I. E.E. (Lond.), 83, Ansari Street, Coimbatore-9, MAS.	1. 1953-56	Burdwan, W. B. 1962 Seshasayee, R., B. E. (Hons.), Dy.
1961 Mehta, K. K. (Col.), B. Sc., AM Brit IRE, Chief Inspector (Electro- nics), Inspectorate of Electronic Equipment, Ministry of Defence	1959-62	Director, Telecommunicati search Centre, P & T Dire New Delhi. 1958 Seymour, J. W., Systems En	on Re- ctorate, agineer,
(CGDP), Hebbal, Bangalore. 1962 Mehta, V., (Lt Col.), B.Sc. C/o. Na-		RCA International Division New Jersey, U. S. A. 1954 Shankar, Uma, Deputy Direct	, Clark, or-Gen- 1957-60
 aught Place, New Delhi. 1960 Muthanna, M. S., B.E., M.I.E., General Manager, Bombay Telephones, Teleph, Bhavan, Colaba, Bombay. 		eral, P. & T., New De 1962 Sundaram, K. N., M.A. (Phys Educational Adviser, Roo 84, M-Block, Ministry of C. A. New Delhi	lhi. .), Asst. m No. S. R. &
1955 Natarajan, R., B. A. Professor of Industrial Management, Indian Ins- titute of Science, Bangalore.	1953-55	1960 Sundaram, P. S. M., B. Sc. (C/o. United Nations To Astt. Board, Khartoum, Su	Engg.) echnical dan.

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1955 Swarup, Shanti, C.E. (Hons.). M.I.E.,

1955 Thadhani, H. R., M.Sc. (Tech. Man-

Box No. 800, Calcutta.

1961 Toshniwal, G. R., (Dr.), D. Sc., Sen,

Ambala Cantt.

Post Master-General, Pb. Circle,

Corporation Pvt. Limited, Post

M.I.R.E., F. N. I., Managing Dir-

ector, Toshniwal Bros. Pvt. Ltd.,

'Rival' Katcheri Road, Ajmer.

chester), C/o Electrical Machines, V.P.1955-56

Service on Year of Council Election

- Service on Council 1960-62
- 1957 Vaish, R. C., B.E., C/o Singhania & Co., 7, Council House St., Cal.
- 1962 Venkataraman, Krishna, M. A. (Physics), Engineer-in-charge, H. P. T., All India Radio, Avadi Camp, Madras.

1959 Wagle, M.M., B.Sc. (Elec. & Mech.), Dip. M. S. W. C. (Chelms.), Engincer-in-charge, Rural Broadcasting, Eros Building, Bombay.

3. LIST OF ASSOCIATE MEMBERS OF THE INSTITUTION :

The Total Number of Associate Members is 300 and they are as follows :

1953-55

1956-57

18	Year of Election	Service on Council	Year of Election	Service on Council
	 1955 Ahuja, I. S., Asst. Director, Communications, Civil Aviation Dept., New Delhi. 1957 Ahhuwalia, J. C. (Maj.), A. I. Dip. (E. E.), A. M. I. E., Second in Commd. & Work Shop Officer, Artillery Static Work Shop Deolali 		 1957 Baij, Nath, (Sqn. Ldr.), T-1, 2, 3, Married Officers' Qrs., Air Force, Palams, Delhi Cantt. 1957 Balachandani, K. M., B. E., Director, Overseas Communication Service, Radio House, Appollo Bunder, Bombay 	
in the second	Maharashtra. 1954 Aiyar, S. S., B.Sc. (Engg.) D.I.I.Sc., Planning Officer, All India Radio.	S. 1955-58	 Balasubramanian, A. S., B.Sc., D.I.I. Sc., Engineer-in-Charge, All India Radio, Eden Gardens, Cal. 	
and and an	New Delhi. 1954 Amberdekar, W. S. (Maj.), B.Sc., AHBTI, (Tech.), Western Com-		 1957 Balasubramanian, T.V., B.Sc. (Hons.), Divisional Engineer, Phones, Hyderabad. 1955 Balasubramanian, T.V., B.Sc. (Hons.), 	
	 Mand Signal Regt. Simia-8. Anand, J. C., (Maj.), B. Sc. (Hons), M. I. R. E. Dip. Marconi College, Asst. Superintendent. (Develop- ment), HQ. Inspectorate of Electro- nic Entiment Paraelles. 		 1955 Banasanuaram, N., B.Sc. (Phys.), Eastern Electronics, New Township, Faridabad. 1955 Banerjee, B. M., M.Sc. (Phys.), Reader, Institute of Nuclear Phys., 92, Acharya Prafulla Ch. Rd., Cal. 	
	1960 Asirvadham, D., (Maj.), B.A., Direct- ing Staff, Offensive Support Wing, School of Land & Air Warfare, Secundrahad		 1957 Banerjee, S. P., M.Sc., Grad. I. E. E. (Lond.), Sr. Engr., Hindustan Cables Ltd. Dt. Burdwan. 1960 Baral, S.S., B. Sc. (Hons.), M.Sc. 	
11111	1960 Awasthi, Y. S. (Maj.), B.A., JCEC, Room No. 112, 'H' Block, DHQ, P. O., New Delhi-11.		D.Sc. Head of the Dept. of Phys. and Communication Engg., B. E. College, Howrab.	
1 Contraction	1954 Bahl, K. N., B.A., R-774, New Rajen- dranagar, New Delhi.		1954 Barreto, T. (Brig), Chief Sig. Officer, Western Command, Simla.	M. 1956-59

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- 1954 Basu, A. (Maj.), M. Sc. (Phys.), A. M. Brit IRE., S. W. D. T., Defence Science Labs., Delhi.
- 1957 Basu, L. M. C/o Burmah Oil Co. (Pipe Lines) Ltd., 1/1 Lower Circular Road, Calcutta.
- 1954 Basu, M. K., M. Sc., Asst. Advisor, Wireless Planning & Co-ordination, Ministry of Transport and Communication, New Delhi.
- 1954 Basu, P. K., M.Sc. (Wireless), Transcription Officer, All India Radio, Broadcasting House, New Delhi.
- 1954 Batra, M. N. (Brig.), C/o National Defence College, New Delhi.
- 1955 Batra, S. K. (Maj.), B.A., Armoured Div. Signal Regt., Jhansi.
- 1956 Bedi, S. S. (Lt. Col.), B. A., C-123, Defence Colony, New Delhi.
- 1950 Benedetti, E. J., M.Sc. (Southampton Univ.), M.A. (Phil), M. A. (Divinity), Principal, St. Xavier's Technical Institute, Bombay,
- 1958 Bhagavat, G.K. (Dr.) B.E. (Hons. Telecomm.), Dr. Ing, (Munich), Fl. No. 13, Inderpuri, Sion West, Bombay.
- 1956 Bhagwat, D. R., (Maj.), Signals, CAFSO's Branch, Air Headquarters, New Delhi.
- 1956 Bhal, S. K., B. Sc., A. M. I. E., WE Directorate (Operational Research Section), MGO's Branch, Army HQ., New Delhi.
- 1961 Bharara, H. L., B.A. (Hons.), Divisional Engg. Phones, Agra.
- 1960 Bharma, N. C. Sqn. Ldr., B.Sc., B.E. (Hons.), A.M.I.E., Student Officer, Defence Services Staff College, Wellington, Nilgiris S. I.
- 1960 Bhasin, B. (Maj.), A.I.Dip.E.E., A.M.-I.E., A.M.M.E.A., Dte. of Production & Inspection (Electronics). Room No. 236, P. Block (CGDP) Ministry of Defence, New Delhi.
- 1957 Bhat, V. J., B.Sc. (Elec. & Mech), Indian Radio and Electronics Corporation, Bombay.

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- 1956 Bhatnagar, H. M., Technical Manager, National Ekco Radio and Engineering Co. Ltd. Bombay.
- 1956 Bhatnagar, U. S., Telecommn. Research Centre, 4th Floor, DG P & T Bldg, Parliament St., New Delhi.
- 1954 Bhattacharjee, D. C., B. Sc., (Hons.), D.I.I.Sc., Director Staff Training School, All Ind. Radio, New Delhi.
- 1959 Bhattacharjee, D. N., B. Sc. (Hons.), M.Sc. (Applied Phys.) 1539 Napier Town, Jabałpur.
- 1959 Bhattacharya, A. B., Manager, Erricsson Telephone Sales Corpn., A.B., No. 5, Commissariat Rd., Cal.
- 1954 Bhide, V. M. (Maj.), Y. Communication Zone Signal Regt., C/o 56 A.P.O.
- 1958 Biswas, G., Sqn. Ldr. Air Force Flying College, Jodhpur.
- 1959 Biswas, N. N., (Dr.), B.Sc. (Hons.), Ph.D. (Engg.), D.I.I.Sc., A.I.I.Sc., A.M.A., L.R.E. Reader in Telecom. Engg., Univ. of Roorkee, Roorkee,
- 1954 Bose, K, K., B.E., Dip. Elec. Com. Engg. (Munich), Dr. Engg. (Munich), Asst. Prof., Indian Inst. of Tech., Kharagpur.
- 1961 Chakrabarty, D. P., B.E.E. Associate Professor of Electrical Engg., Madhav Engg., College, Gwalior.
- 1959 Chakravarty, D. C., (Capt.), Police Radio Officer. Punjab, Simla-3.
- 1958 Chakrabarti, S. K., (Sqn. Ldr), Air Force Station, Chandigarh.
- 1955 Chalke, L. S. J., (Maj.), B.A., Officer Commanding, Boys Regiment, Signal Training Centre, Jabalpur.
- 1958 Chand, Satish, (Sqn. Ldr.), B.Sc. (Engg.), C/o L. Chandra Bal Goela, Asia Chemicals Ltd., 3, East Park Road, Shidipura, Karol Bagh, New Delhi-5.
- 1954 Chandra, H., (Wg. Cdr.), M. Sc. M. 1958-59
 (Phys.), D. I. I. Sc., Base Signal J.S. 1959-60
 Repair Unit, Air Force, Poona. M. 1958-61
- 1954 Chandra, Keshav, M.Sc., Project Officer, All India Radio, Calcutta.

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- 1954 Chatterjee, B., (Dr.), B. Sc. (Hons.), M.Sc., Ph.D. (Elec. Comm. Engg.), F.I.P.S., M.I.R.E. U.S.A., Commn. Engg. Dept., Indian Institute of Tech., Kharagpur, S.E.Rly.
- 1954 Chiphunkar, V. N., M. Sc. (Phys). Lecturer, Dept. of Elec. Commn. Engg., Indian Institute of Science, Bangalore.
- 1954 Chippada, S., (Maj.), B.A., No. 1 Experimental Coy., C/o 56 A.P.O.
- 1960 Choudhury, N. K. D., M.Sc. (Phys.), M.S. (Elec. Engg.), Asst. Director, Central Building Research Institute, Roorkee.
- 1960 Choudhury, M., (Dr.), B.Sc. (Hons), M.Sc., Ph.D., D.I.C., Professor of Electronics, Birla College of Engg., Pilani.
- 1956 Choudhury, S. S. (Lt. Col.) B.Sc. HQ, Inspector General of Assam Riffles, Shillong
- 1954 Chopra, K. S., (Wg. Cdr.), Director of Radio Engg., Air Headquarters, New Delhi.
- 1954 Clement, C. J., B.E., (Elec. & Mech.), Director of Telegraphs, Lucknow.
- 1958 Damodaran, M., (Sqn. Ldr.), Senior Signals Officer, Air Force Station, Hyderabad.
- 1957 Das, D. B., (Sqn. Ldr.), Air Headquarters, Directorate of Signals, New Delhi
- 1961 Das, N. D., (Maj.), B.Sc. (Hons.), M.A., 17, Inf. Div. Sig. Regt., C/o 56 A. P. O.
- 1957 Das Paresh Nath, B. Sc. (Hons.), M. Sc. (App. Phys.), Dept. of Elec. Engg., Univ. of Roorkee, Roorkee.
- 1954 Datta, Saroj., (Dr.), M.Sc., Ph.D. & D.I.C. (Lond), Controller, Radio Construction & Development Unit, Safdarjung Airport, New Delhi.
- 1954 De Sarkar, S. S., B. Sc. (Hons.), D. S. T. E/Tele, Officer of the Chief S & T Engineer, W. E. Rly, Gorakhapur.

- 1957 Deshpande, V. D., (Col.), Military Attache, Indian Embassy, Ankara. 1960
 - Deutler, H. U., Dip. Eng. Tech. (Darmstadt), Managing Director, Siemens Engg. and Mfg. Co. Ltd., New Delhi.
 - 1960 Diwan, R. D. (Capt.), 503 Sigs. HQ P & HP (Indep.) Sub Area, Ambala Cantt.
 - 1960 Dutta, Sambhunath, B. Sc. (Hons.) B.E.E., Project Engineer, (Comms.) Damodar Valley Corporation, 27, Anderson House, Calcutta.
 - 1959 Dwivedi, M. B. (Capt.), M.Sc. (Phys.), 17, Infantry Division Signal Regt., C/o 56 A.P.O.
 - 1960 Fanderlinden, R. B. (Cdr.), Director, Naval Signal Division, Naval HQ, P.O. DHQ, New Delhi.
 - 1960 Ferris, W. V. (Maj.), B. Sc., No. 1, Technical Trg. Regt., Signal Trg. Centre, Jabalpur.
 - 1954 Gadre, B. K., B.Sc., D.I.I.Sc., M.I.E., Narayan Nivas, D. L. Vaidhya Road, Dadar, Bombay.
 - 1954 Gairola, S. N., (Brig.), M.Sc. (Phys.), A.M. Brit. IRE., Chief Signal Officer, HQ XV Corps, C/o 56 A.P.O.
 - 1954 Ganesan, V., (Gr. Capt.), B. Sc. (Hons), Institute of Armaments Studies, Kirkee, Poona-3.
 - 1955 Ghose, A. K., B.Sc. (Hons.), M.Sc. (Appl. Phys.), Reader in Line Communication Engg., Engg. College, Banaras Hindu Univ., Varanasi.
 - 1960 Ghose, S. C. (Sqn.Ldr.), Officer Commanding, Central School Trade Test Board, Air Force, Bangalore.
 - 1954 Ghosh, A. C., M.Sc., Station Engr., All India Radio, Cuttack.
 - Ghosh, B. M., B. Sc., 21, Mahatma 1957 Gandhi Road, Bangalore.
 - 1960 Ghosh, P. K., B.Sc., M. Sc., Deputy Installation Engineer, All India Radio, Calcutta.
 - 1960 Gill, Kulwant Singh, (Maj.), 2 (Indep) Armed Bde Sig Coy. C/o 56A.P.O.

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- 1955 Gill, P. S., (Lt. Col.), B.A. Dir. of M. 1956-57 Sig. (Telecom.), Signals Dte., G.S. Branch, Army HQ., New Delhi.
- 1954 Gokam, G. D., B.Sc. (Phys), Director, Overseas Communication Service, Parliament Street, New Delhi.
- 1954 Goolry, K. S., (Lt. Col.), B.A., Dip. M. S. W.C., Officer Commanding, 2 Coy. Western Comd. Sig. Regt. Ambala Cantt.
- 1954 Gopalakrishnan, K. N., B.Sc. (Hons), D.I.I.Sc., Radio Construction & Development Unit, Safdarjung Airport, New Delhi.
- 1954 Gopalan, S., Gen, Manager, Hindustan Photo Film Manufacturing Co. Ltd., Ootacamund.
- 1955 Gopinath, K., (Maj.), B.Sc. Electronics & Radar Development Est., High Grounds, Post Box No. 108, Bangalore.
- 1955 Gowrishankar, S. M., B.E., Dy. Chief Signal and Telecom. Engineer, S. E. Rly., Garden Reach, Calcutta.
- 1955 Goyal, H. M., (Capt.), B. Sc. (Phys), Secy. J. C.E.C., Room No. 110, H Block DHQ, P. O., New Delhi.
- 1958 Gulati, O. P., M.Sc., D.I.I.Sc., Station Engg. All India Radio, Bhopal.
- 1957 Gupta, J. Das, M.Sc., (Phys.), Meteorologist, Instrument Section, Meteorological Office, Gareshkhind Road, Poona-5.
- 1957 Gupta, J. S., B.E. (Elec.), Associate Professor in Elec. Engg., Madhav Engg. College, Gwalior.
- 1960 Gupta, Ranjit Das, B.Sc., Engineer. Indian Telephone Industries Ltd., Bangalore.
- 1957 Gupta, S. M., Asst. Director of Communications, Civil Aviation Dept., Talkatora Road, New Delhi.
- 1960 Gopte, R. K., (Maj.), A.M.I.E. Army Head quarters, Signal Regt., New Delhi.
- 1960 Harris, G. S., (Sqn. Ldr.), No. 1 Officers' Mess, Indian Air Force, Agra.

Service on Year of Council Election

- 1954 Hart, M. B., (Lt. Col.) No. 1, Tech. Trg. Centre, Sig. Trg. Centre, Jabalpur.
- 1954 Haskell, N., Manager (Retd.), P & T Workshops, Bombay.
- 1955 Hegde, K. S., B. E., M. A. (Engg.), Prof. in Telecommunications, Govt. Engg. College, Guindy, Madras.
- 1959 Iyengar, K. R. K., B.Sc. (Hons.), D.I. I.Sc., M.S. (Elec. Engg.), Dy. Wireless Advisor, Wireless Planning& Co-ordination, Ministry of Trans. and Commn., New Delhi.
- 1956 Janardhan, N. M., B. E. (Telecom.), B.E. (Hons). (Adelaide University), College of Engg. Guindy, Madras-25
- 1958 Jayachandra, M.Sc., Chandra Bhawan 7282, Idgah Colony, Agra.
- 1957 Jayaraman, T. R., B. Sc., D.I.I.Sc., I.A.S., Dy. Commissioner, Dharwar, Mysore State.
- 1959 John, A. G., B. A., M.Sc., Station Eng. All India Radio, Trichur.
- 1954 Joseph, K. P., B. A., Divisional Engineer, Telegraphs, Trivandrum.
- 1954 Joseph, T. T., (Wg. Cdr.), M. A. M. 1956-58 (Phys.) Gen. Manager, Motwane Private Ltd., 127, Mahatma Gandhi Road, Fort, Bombay.
- 1954 Joshi, A. K., (Lt. Col.), B. A., B. Sc., Chief Air Formation Sig. Officer, Air HQ, New Delhi.
- 1958 Joshi, C. P., B.Sc. M.Sc., State Radio Officer, U. P. Circle, Police Radio Section, Dilkusha, Lucknow.
- 1954 Joshi, Dinshaw, F. D., B. Sc., B.E (Elec & Mech), A.M.I.E., Dir. of P. & T., F/71, Sujan Sing Park, Cornwallis Road, New Delhi.
- 1960 Joshi, K. L., B.Sc. (Hons), M. Sc., Dip. Radio Comm., Dept. of Electrical Communication Engg., College of Engg., Poona.
- 1958 Joshi, M. V., B. E. (Elec. and Mech) D.I.C., Senior Scientific Officer, National Phy. Lab. New Delhi.

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 Jowers, Kenneth, Senior Course in Radio Engg. London, Marconi's Wireless Telegraph Co., New Delhi.
 Juneja, R. R., B.A. Dip. Elec. Com.

- (Marconi College, Chelmsford), 27, Rowland Road, Calcutta-20.
- 1954 Juneja, S. V. S. (Lt. Col.), 17, Infantry Divisional Signal Regiment, C/o 56 A. P. O.
- 1954 Kagalwala, Abid, Chartered Electrical Engr., Glolite Elec., Bombay-3.
- 1960 Kale, R. S., B.Sc. (Hons.), D.R.E. (Bombay), D 84, East Vinay Nagar, New Delhi.
- 1954 Kalra, S. N., Dy. Director General M. 1953-56 (TFC), Overseas Communication M. 1957-60 Service, Radio House. Apollo Bunder, Bombay.
- 1954 Kane, John, B. Sc. (Hons.), Phys. London, M. Sc. (Phys.), C/o. M/S. Hindustan Elec. Co., 'Thackersay House', P. B. No. 627, Bombay-1.
- 1954 Kanetker V. P. B.E. (Mech. & Elec.), Director of Telegraphs, Bihar Circle, Orissa.
- 1956 Kant, Rama, B.Sc., B.Sc. (Engg.), (Elec. & Mech.), Dir. of Phones, Post & Telegraphs, New Delhi.
- 1954 Karnik, V. R., (Wg. Cdr.), M.Sc., Signals Directorate, Air Headquarters, New Delhi.
- 1960 Katarya, C. P. (Maj), B.Sc. Radio Officer, Central Reserve Police, Neemuch.
- 1954 Khanna, P. R., B.Sc. (Engg.), Eng.in-charge, A.I.R., Bombay, (Retd).
- 1960 Khanna, R. K., B.Sc., M.Sc., LI.B., D-35, Road No. 1. Andrews Gunj, New Delhi-16.
- 1960 Kheterpal, S. P. (Capt.), M.Sc., 5 Inf. Div. Sig. Regt., C/o 56 A.P.O.
- 1955 Khurana, S. R. (Col.), B.A., M.A., Dir. of Tech. Trg., Gen. Staff Bra., Army HQ P. O., New Delhi-11.
- 1954 Kini, M. M., B.E. (Elec), Director of Planning, Delhi Telephones, Eastern Court, New Delhi.

Flection 1954 Kohli, S. S., M.Sc. Eng.-in-charge, All India Radio, Jullundur.

1957 Kotadia, K.M. (Dr) B.Sc., (Hons), D. I.I. Sc. Ph.D., Sr. M.I.R.E., Reader in Radio Physics & Electronics, Univ. School of Science, Gujarat Univ., Ahmedabad-9. Service on

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- 1957 Kotwal, M. K. (Capt.), B.Sc. 2(IND-EP) Armoured Brigade Signal Co. C/o 56 A. P. O.
- 1958 Krishnamoorthy, K. S. B.Sc. (Hons.) Dip. M.I.T. Cert. Advance Radio Engg. (Marconi College), Officer on Special Duty, Bharat Electronics Limited, Jalahalli, Bangalore.
- 1958 Krishnamurthy, C. R., B. Sc. (Hons.), D. I. I. Sc., Station Engineer, All India Radio, New Delhi.
- 1960 Krishnamurthy, N., B.Sc., Dip Tech. (Rad. Comm.), M.Sc., C/o The Staff Training School, All India Radio, New Delhi.
- 1956 Lahiri, D. B., (Maj.), Military Training Regiment, Signal Training Centre, Jabalpur.
- 1958 Lazarus, N. P., A.M.Brit IRE, R.R. Ac. S., A.M.A.E.S.I., Commn. Superintendent, Air India T HQ, Bombay-29.
- 1961 Lepeltier, R. M., (Maj), 181, Infantry Brigade Signal Co. Headquarters, C/o 56 A.P.O.
- 1955 Luthra, P. N., (Col), B. A., 69, Loči M. 1953-55
 Estate New Delhi-3. M. 1957-58
- 1955' Madan, P., (Col.), B.Sc. (Hons.), Dip. Marconi College (CheImsford) M. 1953-55 Commandant, 509, Army Works, Agra.
- 1955 Maiya, B. C. S., M.A. (Maths.), Divisional Engineer Telephones, Amar, Bldg. Sir. P. M. Road, Bombay-1.
- 1954 Major, D. S., (Lt. Col.), Petit Mansions, 85, Sleater Road, Bombay-7.
- 1954 Malhans, J. S. (Maj.), No. 1, Tech. Training Regt., Signal Training Centre, Jabalpur.

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- 1955 Malhotra, S. K., (Lt Col.), B. A., Asst. Dir, Research & Development Organisation, Ministry of Defence, Room No 23,P. Block, New Delhi.
- 1963 Mani. M. (Miss), B.Sc. (Hons.), Director (Instruments), Meteorological Office, Poona-5.
- 1956 Masand, C. W., B.Sc. (Engg.), D.I.I. Sc., M.S. (Radio Engg.), A.M.I.E., M.A.S.H., R.A.E., Tech. Dir., Masand Industries, Kapurtala.
- 1954 Matange, N. D., B.Sc. (Engg.), M. S. (Electronic Engg.), California, Dy. Planning Officer, All India Radio, New Delhi.
- 1961 Mathews, Thomas, B.Sc., M. Sc., Dip. Tech. (Adv. Radio Commn.), 131, Nehru Road., Santa Cruz, East, Bombay.
- 1955 Mathur, N. S. (Lt. Col.), SO-I (Signals), Signal Trg. Centre, Jabalpur.
- 1957 Mehta, K. M., B.Sc. D.I.I.Sc., Engineer-in-Charge, High Power Transmitters, All India Radio, Bombay.
- 1958 Menon, G. K. (Sqn. Ldr.), Dip, Radio Commn., B.S.R.U., Indian Air Force Stn., Poona.
- 1954 Menon, G. U., B.Sc. (Phys.), B.Sc. (Engg.), Dy. Chief Engineer, Posts & Telegraphs, New Delhi.
- 1954 Mirchandani, H. J., B.E. (Mech. & Elec.), Chief Engineer (Transmission) Indian Telephone Industries Ltd., Bangalore.
- 1956 Mishra, S. C., B.Sc. A.M.I.E.E. Pt.I., Regional Manager, Indian Telephone Industries, 28/F Nalin Sarkar Road, Calcutta.
- 1955 Mitra, S. N., M.Sc. (Cal.), M.Sc. J.S. 1959-60 (Cantab), F. N. I., Research Engi-Neer, A. I. R. New Delhi.
- 1957 Mittal, R. N., B. Sc., B. E. (Hons.), Philips India Limited, 'Philips House', Calcutta-20.
- 1955 Mitter, E. A., (Maj.), B.A. 8, Commission Lane, Delhi-6.
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- 1960 Mohan, M. Ananda, L. E. E. Seuior Tech. Officer, Office of the D. G., Civil Aviation Dept. Talkotora Rd, New Delhi.
- 1958 Mohanty, A. P., B.Sc. Superintendent of Police (Signals), Cuttack.
- 1954 Mohindra, L. C., Grad. I.E.E., Divisional Signal & Telecommunication Engineer, Northern Rly. New Delhi
- 1957 Mukherji, S. N., B.Sc. (Hons.), M.Sc., Governing Director, W.J. Alcock & Co., 7, Hastings Street, Calcutta.
- 1960 Mukherji, P. K., (Maj.), Indian Military Academy, Dehra Dun.
- 1957 Murgai, B. S., Engg. Officer, Delhi Telephone District, Eastern Court, New Delhi.
- 1959 Muthuswamy, A. S., B. Sc., 23/289, Paradise Building, Flant Road, Sion East, Bombay.
- 1955 Nabar, S, M., B.Sc. (Hons.), D. I. I. Sc., A.M.I.E., Superintendent of Police (Wireless), Govt. Flat 'D', Arsanol Rd., Poona-1.
- 1955 Nagaraja, N. S., (Dr.), B.Sc. (Hons.), Ph. D. D.I.I.Sc., Lecturer. Indian Institute of Science, Bangalore.
- 1955 Nagarajan, M. S., M. A., A.M.I.E., Electronics Wing, E M E School, Trimulgherry P.O., Secunderbad-15
- 1954 Nagarkar, P. S., B.E. (Elec.), D. I. I. Sc., Engineer-in-charge, All India Radio, Bangalore-1.
- 1955 Nageswaran, K., M.Sc., (Phys.), D.I. C., (London), RESA Company, Mount Road, Madras.
- 1954 Naidu, R. K. R., (Capt.), B.A., Signals Wing, Wireless Experimental Centre, Delhi Cantt.
- 1954 Naidu, V. K. P., B.A. (Phys.), Senior Communication Officer, Civil Aviation Dept., New Delhi.
- 1954 Nair, C. U. K., (Lt. Col.), B. A., Signals Directorate, Army Headquaters, New Delhi.

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M. 1953-55

M. 1956-58

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- 1960 Nair, K. K., B. Sc., M. S., D.I.I.Sc., Professor of Telecommunication Engg., College of Engg., Osmania
- 1958 Nambiar, K. M. K. (Sqn. Ldr.), B.A., A. M. Brit. I R E., Joint Cypher Bureau, Ministry of Defence, C-1, Hutments, New Delhi.

University, Hyderabad.

- 1958 Nambudiripad, M., B. Sc., A.M. Brit. IRE., St. Albert's College, Ernakulam.
- 1959 Nanda, C. M. (Maj.), B. A., M. A., C/o National & Grindlays Bank Ltd., 10 Parliament Street, New Delhi.
- 1955 Narasimaih, B. N., No. 1642, Nagappa Block, Srirampuram, Bangalore.
- 1959 Narasimhan, P. R., B. E., No. 97, Pandara Road, New Delhi.
- 1961 Narasimhan, R. (Maj.), 312, Pandara Road, New Delhi-11.
- 1958 Narayanan, V. S. (Sqn. Ldr.), B. Sc. (Hons.), Asst. Director of Signals, Air Head Quarters, Indian Air Force, New Delhi.
- 1954 Narayanaswamy, A. S., M.Sc. (Phys.), Engineer-in-charge, All Ind. Radio, Tiruchirapalli.
- 1954 Nerurkar, B. Y., B. E. (Elec), Planning Officer, All India Radio, New Delbi.
- 1954 Nilakantan, P. S., B.A., M.Sc. (Phys.) Cert. Prof. I. I. Sc., Dy. Planning Officer, All India Radio, New Delhi.
- 1959 Ohri, D. D. (Sqn. Ldr.), Directorate of Signals, Air Headquarters, New Delhi.
- 1954 Pai, M. V., B.Sc. (Engg.), BEN. A.I. R.E., A.M.I.E. (Ind). Chief Engr., Overseas Commn. Service, Appollo Bunder, Bombay.
- 1957 Pal, P. C., B.Sc., M.Sc., Reader in V.F. & Carrier Telecommunication Engg., Govt. Engg. College, Jabalpur.

1954 Palekar, D. W., M.Sc., B.Sc., A.C.G. I., A.M.I.E., (Lond.), Installation Engineer, All India Radio, Tiruchirapalli. Service on

Council

- 1959 Pandhi, Ranbir, (Sqn. Ldr.), Senior Signal Officer, No. 4, Wing, A. F. Stn., Agra Cantt.
- 1954 Panwar, B. S. (Lt. Col.), Commander, HQ. Tusker, Signal, Tusk Forces, GREF C/o 56 A.P.O.
- 1955 Patil, N. A. (Lt. Col.), Officer Commanding, Tech. Wing., School of Signals, Mhow.
- 1954 Pattabhiraman, J., B. Sc. (Phys.), D. I. I. Sc., Senior Tech. Officer, Aeronautical Communication Service, Regional Office Civil Airport, Madras,
- 1954 Pattabhiraman, S., M. A. (Phys.), D.I.I.Sc., Engineer-in-Charge, All India Radio, Ahmedabad.
- 1954 Patterson, W. D. (Maj.), B. Sc. School of Signals, Mhow.
- 1958 Parthasarathy, M. N., B.Sc. (Hons.), Radio Engineer, State Broadcasting Government of Madras, Madras.
- 1954 Phatak, D. V., B.E., Dy. Planning Officer, All Ind. Radio, New Delhi.
- 1954 Pichumani, K. K., Divisional Engineer (Retd.), Posts & Telegraphs, 10, Promenade Road, Tiruchirapalli.
- 1960 Pinto, K. A. J. (Sqn. Ldr.), A. F. Officers Mess, Palam, Delhi Cantt.
- 1960 Prabhu, M. A., B.A., Chief Installation Test Engineers (VHF), Bharat Electronics, Jalahalli, Bangalore.
- 1957 Puri, Y. R. (Lt. Col.), HQ, M. & G. Area, Colaba, Bombay.
- 1954 Raghavachari, R., B.Sc. (Hons.), D.I. I.Sc., Maintenance Engineer, All India Radio, New Delhi.
- 1958 Rai, B. K., (Maj.), B. Sc., D.I.I.Sc., School of Signals, Mhow.
- 1958 Rajagopal, D. (Wg. Cdr.), B.Sc., Air Force Technical College, Jalahalli, Bangalore.

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> 1954 Rajagopalan, B., B. A., Dy. Chief Engineer, P & T, New Delhi.

- 1954 Rajan, R. M. (Capt.), B. Sc. (Phys.), Signals Directorate, Army H.Q., New Delhi.
- 1957 Raju, T. A., B. Sc. (Phys.), M. Sc., (Radio Physics), D.R.E. Lecturer in Telecommunications, New Engg. College, Vishrambag, Sangli.
- 1954 Ramachandani, D. N., B.E. (Mech. & Elec.), Post Master General, Beaulieu, Bangalore,
- 1960 Ramadoss, E. N. (Maj.), B. Sc., HW INF., BDE, C/o. 56, A. P. O.
- 1955 Raman, K. V., B.A. (Phys.), Director of Telegraphs, Posts & Telegraphs, Calcutta.
- 1955 Raman, S. (Maj.), M. A., (Maths.), B.Sc. (Phys.), A.M. Brit. IRE., M. I.R.E., E.M.E. 32-33 Khyber Pass Hostel, Kashmir Gate, Delhi-6.
- 1960 Ramanathan, G., B. Sc., D. I. I. Sc., D.I.C. (Lond.), Station Engineer, All India Radio, Patna.
- 1958 Ramnany, P. U. (Sqn. Ldr.), HQ. Directorate of Signals, Indian Air Force, New Delhi.
- 1955 Rana, S. K., B. Sc. (Hons.), Asst. Chief Engineer, P & T, New Delhi.
- 1954 Ranagnathan, S.N., B.E., (Elec.)Chief Controlier of Telegraph Stores, P & T Dept., 5, Council House Street, Calcutta.
- 1954 Ranji, H. K. (Maj.), B.E. (Elec.), Signals Directorate, Army Headquarters, New Delhi.
- 1956 Rao, B. N. (Maj.), B.Sc., Signals, 2/Signals Dte., Gen. Staff Branch, Army HQ, New Delhi.
- 1956 Rao, G. R. S., B. Sc., (Hons.), M. Sc., D.I.I.Sc., National Ekco Radio & Engg. Co. Ltd., Mahaluxmi, Bombay.
- 1960 Rao, K. L., B.Sc., B.A., D.I.C., M.A. (Cantab), A.M.I.E.E., M. I. R. E., Asst. Research Engineer, All India Radio, New Delhi.

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- 1958 Rao, M. S. Balakrishna, B.E. (Elec.), Dir. of P. & T., Assam, Circle, Shillong, Assam.
- 1959 Rao, P. L. Sharma, 124, Krishnarajendra Rd, Basavangudi, Bangalore.
- 1958 Rao, S. (Sqn. Ldr.), Base Signal Repair Unit, Ind. Air Force, Poona.
- 1958 Rao, V. Hanumantha, B.E. (Telecom), Dy. Supt., Police Commns. Hyderabad, A.P.
- 1958 Rao, V. Kappu, B. A., Divisional Engg. Telephones (Retd.), Posts & Telegraphs, Bombay
- 1957 Rao, V. V., B. Sc. Dy. Wireless Advisor, Ministry of Transport and Co-ordination, Ministry of Transport & Comm., New Delhi,
- 1957 Ray, A. K., B. Sc. (Hons), M. Sc., Executive Engineer, Comm. Division, D.V.C., P.O. Maithon Dam.
- 1954 Ray, N. C., M.Sc., (Phys.), D.I.I.Sc., Sr. Superintedent of Police (Radio) Bhopal.
- 1962 Reddi, K. L., B.E. (Elec.), Dir., Telegraph Est., P & T Dte, New Delhi.
- 1959 Row, C. V. Suryanarayana, (Sqn. Ldr.), B.E., D.I.I.Sc., A.M.I.E., A. M.A. Re. S. I., 15, West Kidwai Nagar, New Delhi.
- 1955 Row, K. S. (Maj.), B.Sc., No. 1. Wireless Experimental Coy. C/o. 56, A.P.O.
- 1961 Roy, R., 158, Monmatha Datta Rd., Flat No. 13, Calcutta-37.
- 1954 Sabhaney, I. W., (Wg. Cdr.), Officer Commanding, No. 3, G. T. S. Air Force Station, Jalaballi, Bangalore.
- 1957 Sahdev, N. L., M.Sc. (Phys.), International Teleocommunication Union, Geneva.
- 1955 Sahni, D. N., (Lt. Col.), B.A. (Hons.) B.E. A.M. Brit. IRE, OLT (Sigs) Principal, Sainik School, Amravathi Nagar, Coimbatore.

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- 1954 Sajnani, N. B., B. Sc., Munchen-13, Ainmillerstr. 42/IV, West Germany.
 1956 Samant, M. G., (Prof.), B.Sc., (Phys),
- D.I.I.Sc., College of Engg., Poona. 1958 Sampath, S., (Prof.), B.Sc., (Hons.),
- D.I.I.Sc., M. S. (Electronic Engg), Professor, Indian Institute of Technology, Madras.
- 1957 Sampson, D.S., (Sqn. Ldr.) B.S.R.U., Air Force Station, Poona.
- 1958 Sandhu, G. S., B. Sc. (Hons.), Asst. Engineer, P & T Directorate, New Delhi.
- 1959 Sankararaman, S., B. E. (Hons), Works Manager (Transmission) Indian Telephone Industries Ltd., Duravani Nagar, Bangalore.
- 1958 Sankaranarayanan, (Sqn. Ldr.), M.Sc. (Phys.), 123-125, Khyber Pass Hostel, Alipore Road, Civil Lines, Delhi-6.
- 1954 Sapre, S. D., (Wg. Cdr.), B. A. (Hons.), B.Sc., D.I.I.Sc., Air Force Technical College, Indian Air Force, Jalahalli, Bangalorc.
- 1954 Sarin, D. D., B.Sc. (Engg.), Engineerin-Charge, High Power Transmitters, All India Radio, Khampur.
- 1954 Sarin, J. C. (Maj.), B. Sc. (Phys.), Grad Brit IRE., 2 Coy T. Commn. Zone, Signal Regiment, C/O 56 A. P. O.
- 1954 Sawhy, R. N. R., Military Attach, Embassy of India in Ethiopia, Addis Ababa, C/o Min. of External Affairs, New Delhi.
- 1954 Sehgal, J. L., B. A., Scientific & Technical Officer Grade 1, Telecom. Research Centre, P & T Dte, Parliament St., New Delhi.
- 1956 Sen. D. N., B. Sc. (Hons), M. Sc. Martin Burn Limited, 12 Mission Row, Calcutta-1.
- 1957 Sen, N. K., M. Sc., Martin Burn Limited, 12, Mission Row, Calcutta-1.

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1959 Sen, R. C., Dip. Radio Communication from Chelmsford College, Senior Communication Officer, Office of the Controller of Communications, Calcutta Region, Calcutta Airport, Calcutta.

1960 Sen, S. N., B. Sc., D. I. I. Sc., Planning Officer, P & D Unit, Ali India Radio, New Delhi.

- 1954 Seshamani, B. (Lt. Col.), B. Sc. Commanding Officer, Eastern Command, Signal Regiment, Lucknow.
- 1961 Sethi, N. J. S. (Lt. Col.), S. O.-1, (Signals), 425 Western Comd., Simla-3
- 1957 Shah, J. G., (Dr.), B.E. (Elec)., D.I.I. Sc., Ph. D., A.M.I.E., A.M.I.E.E. (U. S. A) C. V. M. Bangalow No 14, Vallabh Vidyanagar, (Via.) Anand, Gujrat.
- 1955 Shahani, J. N., (Lt. Col), M. Sc., M. 1953-55 M, Brit IRE Senior Scientific J.S. 1960-Officer, Joint Communication Eletronics Committee, Cabinet Secretariat, Room No. 108 H. Block, New Delhi.
- 1956 Shahaney. B. J., (Brig) A. C. G. I. M. 1960-(Lond) Director of Electronics, Research and Development Organisation, Room No. 18, P. Block. Ministry of Defence, New Delhi.
- 1959 Shenoi, N. V., B. E (Elec.), M. 1959-General Manager, Indian Telephone Industries Ltd., Doorvaninagar, Bangalore.
- 1960 Shrivastava, K. K., B. E. (Hons), Lecturer in Electronic Engg., College of Engg., Poona.
- 1957 Shukla, R. (Sqn. Ldr.), No 5, Wing Air Force Station, Kalaikunda, W. B.
- 1958 Sil, B. C., M. Sc., 3/2, Srinath Mukherjee Lane, Calcutta.
- 1954 Singh, Ajit, (Col.), B. A., Commandant, Signals, Armed Div., Jhansi.

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- 1954 Singh, Bhagwant, (Capt.), B. Sc., School of Signals, Mhow, M. P.
- 1954 Singh, B. N., B. Sc. (Hons.), M. Sc. (Wireless), D. Sc., D. C. S. O. (Air), Defence Science Organisation, Ministry of Defence, New Delhi.
- 1958 Singh, Gurmukh, (Sqn. Ldr.), Dip. Elec. Engg., Base Signal Repair Unit, Poona.
- 1956 Singh, Hari, (Lt. Col.), B.Sc. (Hons), M. Sc., Dy. Chief Sig. Officer, HQ U. P. Area, Bareilly.
- 1954 Singh, Hazara, (Lt. Col.), Officer Commanding, Eastern Command Signal Regiment, Lucknow.
- 1954 Singh, Jagir, (Sqn. Ldr.), B. A., Deputy Director of Signals, Air Head Quarters, New Delhi.
- 1954 Singh, Jaswant, (Brig), C/o National Defence College, 6, Tees January Marg, New Delhi.
- 1954 Singh, Joginder, (Maj.), B. A., 33
 Corps, Signal Regiment, C/o 56
 A. P. O.
- 1954 Singh, Shiv, (Mai.) Uttar Pradesh Area, Indep. Sig, Co., Bareilly.
- 1954 Sinha, A., Dy, Director, P & T., Assam Circle, Shillong.
- 1958 Sinha, K. N., (Sqn. Ldr.), B. Sc., D. R. E., Base Sig. Repair Unit, Air Force Stn., Poona.
- 1957 Sinha, N. K. (Dr.), B. Sc., Ph. D., Associate Professor of Electrical Engg., Bihar Institute of Tech., Sindri.
- 1958 Sivaswami, R. S., (Sqn. Ldr), B. A., B. E., Air Headquarters, New Delhi.
- 1957 Smith, D. C., (Maj), Officer Commanding, 23, Inf. Sig. Coy., C/o. 56 A. P. O.
- 1960 Sobti, B. K., (Capt). B. Sc., HQS., Alternative Delegate (Indian) I. C. S. C. for Loas, Vientiape.

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- 1957 Srinivasan, K. V., B. E., Dip. E. E. (Hons), Director of Telegraphs, Rly. Electrification Project, Calcutta.
- 1959 Srinivasan, S., M. Sc., (Phys.), Asst. Director, Indian Standards Institution, New Delhi.
- 1958 Srinivasan, T., (Gr. Capt), B. Sc., (Hons.), Director of Signals, Air Head-quarters Now Delhi.
- 1954 Subburatnam, S., B. Sc. (Hons.) Meenakshi Vilas No 9, Venkata Rama Iyer St., Tiyagarayanagar, Madras-17.
- 1960 Subrahmanyam, B. A. S., B. Sc., Wire Broadcasting Station, Municipal Officer, Rajahmundry.
- 1955 Subrahmanyam, Ganti, B. E. M. A. (Engg.) E. E., M. I. R. E., Prof. of Telecom. Engg., College of Engg., Kakinada.
- 1957 Subrahmanyan, T. R., B. E. (Telecom.), Manager, Electricals Division, Voltas Limited, 7/1 Asaf Ali Rd., New Delhi,
- 1958 Subramanian, A., B. A. (Hons.), A. M. I. E. E. Divisional Engineer, Phones, Madras District, Madras.
- 1955 Subramanian, C. R., B. Sc., (Phys), M. S. (E. E.), D. I. I. Sc., National Aeronautical Laboratory, Jayamahal Road, Bangalore.
- 1958 Subramanian, T. S., B. Sc. (Engg.), Dy. Director, Telecommunication Research Centre, Post and Telegraphs, New Delhi.
- 1955 Sud, B. D., C. E. (Hons.), M. I. E., General Manager, Delhi Telephones Dist., New Delhi.
- 1954 Sujan, V. B., Dip. Elec. Engg. Faraday House E. E. College, London. 8, Jenkins House, Hornby Road, Appollo Bunder, Bombay.

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1954 Suri, R. L., B. A., A.M.I.E.T., M. A.

Sig. Trg. Centre, Jabalpur.

1954 Tandon, R. K., M. Sc. (Phys.), B.Sc.

1954 Taskar, N. T., B.Sc., B.E., Dy. Direc-

1954 Thiruvenkatachari, S., B.Sc. (Hons.),

1956 Tod, D. S., B. Sc. (Hons.) Manager

1961 Tyagi, B. D. (Maj.), M. E. (Mech),

1961 Upasani, B. P. (Capt.), Defence

1954 Vaidya, K. D., B. E., Dy. Chief

1954 Varma, B. D. (Capt.), B. Sc., B. E.

Wing, Willington S. I.

Kirkee, Poona-3.

Switzerland.

Research Centre, New Delhi.

Avenue, New Delhi.

I. P., F. A. S. A., 8 Queen Mary's

(Elec. Comm. Engg., London), A.

C. G. I. Senior Scientific Officer,

tor, P. & T., Telecommunication

D. I. I. Sc., Director, Frequency

Assignments, A. I. R., New Delhi.

& Dir., Automatic Telephone and

Electric Co. India Ltd., Bangalore.

A. I. D. E. E. (Elec), A. M. I. E.,

Institute of Armament Studies,

Service Staff College, Army

Engineer, P. & T., New Delhi.

(Hons.), A. M. I. E., E M E, HQ C/o. Mrs. Contraves Ag., Sehaff-

hauserstr-580, ZURICH-11/52,

National Phy. Lab., New Delhi.

1954 Talwar, K. N., (Col.), Commandant, J.S. 1958-59

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- Service on Council
- 1954 Varma, M. V. Rama, B. A., B, Sc., Director of Telegraphs, Ambala.
- 1954 Venkataramaswamy, S. V., B. Sc., (Hons), A. M. I. E., D. I. I. Sc., Station Engineer, All India Radio, New Delhi.
- 1954 Venkataramiah, Y., B. Sc., (Hons), A. M. I. E., D. I. I. Sc. Planning Officer, Planning and Development Unit, All India Radio, New Delhi.
- 1956 Verma, I. D., (Brig), Chief Signal Officer, HQ Eastern Command, Lucknow.
- 1959 Virdee, K. S. B. Sc., Semi-Conductors, Behind Block No 25, W. Petal Nagar, New Delhi-12.
- 1960 Virdi, T. S., (Lt. Cdr.), Secretary, Joint Communications and Electronics Committee, Cabinet Secretariat, New Delhi.
- 1957 Wagle, M. M., B. E. (Mech and Elec), Technical Officer, India Stores Dept., C/O Indian High Commission, London.
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ABBREVIATIONS USED ABOVE :

P.-President

V. P.-Vice-President

T.-Treasurer

S.-Secretary

J. S .--- Joint Secretary

[We would request our members to kindly intimate to us their present designations address, any mistakes, additions and alterations in their listed qualifications.-ED.]

4. LIST OF GRADUATE MEMBERS OF THE INSTITUTION :

[The total number of Graduates of the Institution is 492 and they are as follows. This is the first time that a comprehensive list of all Graduates has been compiled. We realise that the list does not give the present designation of many members. We would request our members to kindly intimate to us their present designations and addresses and also intimate to us any mistakes and additions or alterations in their listed qualifications.— ED.]

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- Thirunarayanan, M. W., B. Sc. (Hons), Planning & Development Unit, All India Radio, Akashwani Bhawan, Parliament Street, New Delhi.
- Thomas, John, B. Sc., S. D. O. Telegraphs, Gauhati, Assam.
- Thomas, S. I. T., M. A. (Phys), Asst. Meteorologist, 24/2 Tank Lane, Santacruz, West, Bombay.
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- Tikare, N. D., (Capt), M. Sc. (Wireless), SSO-1, LRDE, Bangalore,
- Tiwari, V. M., Flg. Offr., B. E. (Hons), Officers' Mess. Air Force Station, Agra.
- Tripathi, A. N., B. Sc. (Engg), G/4 (Old) Banaras . Hindu Univ., Varanasi-5.
- Tripaty, B., B. Sc. (Hons), M. Sc. (Tech), 28/8/1 Nakuleswar Bhattacharya Lane, P. O. Kalighat, Calcutta-26.
- Trivedi, N. K., M. Sc., DAPO Planning & Development Unit, Akashwani Bhawan, Parliament Street, New Delhi.

- Unni, K. M., B. Sc., Engg. Supervisor Planning, Office of the Divisional Engineer/Telegraphs, Shillong Division, Shillong.
- Vedwa, R. K., (Plt. Offr), B. Sc., Officers' Mess, Air Force Station, Palam, Delhi Cantt.
- Vaid, R. C., B. A. (Phys), Engg. Supervisor Phones, Ferozepore, Pb.
- Vaidyanathan, G., B. Sc., Moloyour Post, Anatandayapuram (Via), Madras.
- Vaidyanathan, K. R., B. Sc., A. M. I. E., C/O Project Officer, All India Radio, Kaiser-i-hind Building, Ballard Estate, Bombay.
- Varadarajan, S. M., B. E., D. I. I. Sc., Station Engineer, All India Radio, Hyderabad.
- Vasanarajan, M. N., Dist. Signal & Telecom. Engineer, Western Rly., Dohad.
- Vaze, P. K., Radiation Hazards Control Sec., Health Physic Div., Atomic Energy Est., Trombay, Bombay-73.
- Venkataraman, K. R., B. A., Asst. Engineer, P & T No. 3, Hunter Lane, Vepery, Madras-17.
- Venkataraman, R., Asst. Engineer, Co-axial Equipment Installation, Telegraph Office Compound, Varanasi Cantt.
- Venkataraman, V., Engg. Supervisor, Phones, 56, Bazulla Road, T. Nagar, Madras.
- Venkataramanan, K., B. Sc. (Hons), D. I. I. Sc., Asst. Professor, Birla Engg. College, Pilani.
- Venkatasubramanian, P. K., B. Sc. (Hons), Research Department, All India Radio, Akashwani Bhawan, Parliament St., New Delhi.
- Venkatasubrahmanyam, V., M. A. (Phys), Asst. Engineer, All India Radio, Gauhati, Assam.
- Venkatasubramaniyan, B. Sc., 9, Ramanathan Street, T' Nagar, Madras.
- Venkateswaran, P. H., No. 16B, St. No. 23, Sector X, Bhilai Steel Project, Bhilai.
- Venkatesan, K., B. Sc., 55, Ganesh Maha, 18th Cross I Main Road, Malleswaram, Bangalore-3,

- Venkateswarulu, N., B. Sc. (Hons), D. I. I Sc., Asst. Station Engineer, All India Radio, Vijayawada, A. P.
- Venkitachalam, H., B. Sc. (Hons), Electrical Supervisor, C. Telegraph Office, Eastern Court, New Delhi.
- Verma, H. C., (Flt. Lt.), B. E. (Hons), No. 10 Wing Air Force, C/O 56 A.P.O.
- Verma, R. C., Y Communication Zone, Signal Regt., C/O 56 A.P.O.
- Vidyarthi, G. P., Asst. Engineer, Telephones, Telephone Bhavan, Colaba, Bombay.
- Visveswariah, B. V., (Capt), B. Sc., 27, Inf. Div. Sig. Regt., C/O 56 A.P.O.
- Viswanadhan, Challa, M. Sc., M. Tech., Room No. 30, National Physical Labs., Hill Side Road, New Delhi.
- Viswanathan, T. K., Asst. Engineer. Eastern Area Installation, Tech. & Development Circle, Posts & Telegraphs, 7th Floor, Telephone Bhavan, Calcutta.
- Viswanath, S. N., (Maj), Defence Services Staff College, Wellington, Nilgiris Hills, S.I.
- Vithal, D, V. R., Lecturer, Dept. of Elec. Engg. College of Engg., O.U., Hydrabad-1.
- Wadhawa, K. L., B. Sc. (Hons), C/O Dr. Mala Ram, 38/3 Delhi University Flats, Probyn Road.
- Wadhwa, K. S., (Capt), B. Sc., 40/12 East Patel Nagar, New Delhi.
- Wartikar, P. N., M. Sc., 4, Chandrodoya Society, Narjivari, Ahmedabad-1.
- Zakria, M., Sub Divisional Officer (Pl:ones), Hyderabad.

APPENDIX-I

List of Papers Published in the Journal of the Institution and the Students' Journal.

Vol. 8, (1962) : No. 1, January 1962.

- 1. Evaluation of Amplification Factors in Multi-Grid Tubes by An Electrolytic Tank Method-S. Sampath and K. Venkataramanan.
- 2. Control Characteristics of 4-Layer Silicon Controlled Rectifier-K. K. Bose.
- Synthesis of Control-Grid Structure for Remote Cut-off Tubes from the Transfer Characteristic-K. Venkataramanan.
- 4. High Speed Computer Switching Circuits-Y. N. Bapat.
- One Operational Amplifier Simulates Third Order Systems with Simple Lead-L. K. Wadhwa.

Vol. 8, (1962) : No. 2, March 1962.

- 6. Film Recording in Television-G. G. Vaswani.
- 7. A Technique for the Measurement of Q-J. K. Sinha and S. Sundaram.
- 8. Design of an Electronic Correlator Using Magnetic Drum Delay System-D. D. Majumdar.
- 9. On Some Design Problems of a Star Type Ferrite Circulator-S. J. Lewandowski,
- 10. The Polish Television Receiver 'Koral'-R. Nowicki.

Vol. 8, (1962) : No. 3, May 1962.

- 11. Hard Tube Pulse Repetition Frequency Multiplier-S. V. Dabadghao.
- Efficiencies of Loudspeakers and a Simple Graphical Procedure for their Calculation --K. C. Chadha.
- Stability of an R. P. C. Servomechanism with Hard Spring Non-linear Characteristic -G. N. Acharya.
- 14. Cylindrical Triodes with Nearly Circular Grids-N. Seshagiri.
- 15. On Adaptive Systems-D. V. R. Vithal.
- 16. Acoustical Environment for Calibration of Microphones-K. D. Pavate, J. D. Jain and M. R. Kapoor.

Vol. 8, (1961) : No. 4, July 1962.

- 17. Electromagnetic Waves on a Semi-infinite Conically Tapered Circular Dielectric Rod -Anand Kumar and (Mrs.) R. Chatterjee.
- Total Electron Content in F₂ Layer over Madras during 1959-C. S. R. Rao and Mangal Sain.
- 19. The Validity of an Approximation to the Magnetoionic Formulae-Y. S. N. Murthi.
- 20. Transistor Wien Bridge Oscillator-S. C. Dutta Roy.
- 21. Automatic Registration of Critical Frequency Variation of Ionospheric Layers-J. K. Sen.
- 22. Recent Development in Microwave Communication Technique-M. Morita.

Vol. 8, (1962) : No. 5, September 1962.

- On the Design of Parallel-T Resistance Capacitance Networks for Maximum Selectivity

 S. C. Dutta Roy.
- 24. A Note on the changes of Maximum of Ionization of the F, Layer Associated with the Sunspot Activity-G. S. G. K. Setty and K. R. Rao.

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25. Wiener Optimization of Linear Control System-T. N. Shiva Shankar.

- 26. Ionospheric Observation at Madras during the I. G. Y. and I. G. C.-S. Rangaswamy and (Miss.) S. C. Krishnan.
- Impedance Matching of Sectoral Electromagnetic Horn Antennas by Shorting Grilts-S. Hariharan and K. Gopalakrishnan Nair.

Vol. 8, (1962) : No. 6, November 1962.

- A Practical Comparison between Different Methods of Calculating Sky-Wave Field Intensity - K. C. Chadha.
- 29. A Comparative study of the Performance of Class C Harmonic Generator with Fractional Sine Wave, Isoscales, Triangle and Rectangular Pulse Drive--K. S. Patel.
- One Operational Amplifier Simulates Third Order System with a Lead and a Time Constant -L. K. Wadhwa and H. S. Rao.
- Radiation Patterns Produced by a Linear Array of Half Wave Dipole Coupled Electromagnetically to a Wire Transmission Line-D. L. Sen Gupta.

32. Developments of Scintillation Counter System for X-rays-A. E. Kiss and N. Patla.

33. International Radio Consultative Committee-M. D. Sant.

Students' Journal.

Vol. 3, 1961 : No. 1, December 1961.

Standing Waves in Uniorm Transmission Lines—V. Ramachaudran. The Telephone Exchange—Line Circuits—S. C. Mishra, Television System—IV—Contributed.

Vol. 3, (1962) : No. 2, March 1962.

Antenna Systems—Directional Antennas—Contributed. Impedance Matching by Uniform Transmission Lines—V. Ramachandran. Television Systems—V—Contributed.

Vol. 3, (1962) : No. 3, June 1962.

A Note on the Analysis of Two-stage Cascade Amplifier Using Y Parameters – A. S. Sharma,

Stability in Feedback Amplifiers - S. Sampath.

Telegraph Transmission Lines-V. Ramachandran.

A Triggcred Time Base Generatory-K. K. Shrivastava, S. B. Joshi, K. K. Karandikar and R. N. Kusi.

, A. Kalanaka) and K. N. Kusi.

Vol. 3, (1962): No. 4, September 1962.

The Advent of the Transistor-S. Sampath. Antenna Systems-Arrays of Linear Elements-Contributed. Telephone Transmission Lines-V. Ramachandran. Television Systems-V-Contributed.

APPENDIX-II

List of Papers Presented at the Fifth Technical Convention

- Acoustical Environment for Calibration of Microphones-K. D. Pavate, J. D. Jain and M. R. Kapoor.
- 2. Atmospheric Radio Noise-M. K. Basu and K. R. Phadke.
- 3. Control Characteristics of 4 Layer Silicon Controlled Rectifier-K. K. Bose.
- Development of Reflex Klystrons--L. Torstensson, N. C. Vaidya, K. Chandra, S. Ram Gopal and R. C. Vatsa.
- Efficiencies of Loudspeakers and a Simple Graphical Procedure for this Calculation-K. C. Chadha.
- Evaluation of Amplification Factors in Multi-Grid Tubes by An Electrolytic Tank Method

 Sampath and K. Venkataramanan.
- 7. Film Recording in Television-G. G. Vaswani.
- 8. Frequency Modulation of Transistor Oscillators-S. Basavaiah.
- Generation of Special and Arbitrary Waveforms using Binary Counters-P. Malhotra and R. Parshad.
- 10. Harmonic Distortion in Transistor Amplifiers J. C. Shouri,
- 11. High Speed Computer Switching Circuits-Y. N. Bapat.
- Ionospheric Observations at Madras during I. G. Y.-S. Rangaswamy and Miss S. C. Krishnan.
- 13. Laplace Transforms for Transistors-M. V. Joshi and P. K. Rangole.
- 14. Measurement of S Values in Wireless Monitoring-B. S. Nargas and V. D. Pethe.
- Methods for Accurate Measurement of Standing Wave Ratios at Microwave Frequencies --R. Parshad and S. Roy Choudhury.
- 16. Modified Cavity Resonator Method of Measuring Dielectric Constants J. K. Sinha,
- 17. On Adaptive Systems D. V. R. Vithal.
- One Operational Amplifier Simulates Third Order Systems with Simple Lead-L. K. Wadhwa.
- 19. On Some Design Problems of a Star Type Ferrite Circulator-S. J. Lewandowski.
- On the Space Charge-Limited Current Flow from a Circular Cathode to an Elliptic Anode —N. Seshagiri.
- 21. Polish Television Receiver "Koral"-Ryszard Nowicki.
- 22. Practical Comparison between the Different Methods of Calculating Skywave Field Intensity-K. C. Chadha.
- 23. Prediction of Reliability of Ground Electronic Equipment-S. S. Mani.
- 24. Reducing Cubic Distortion of Speech Signals due to Voltage Limiting-Rajendra B. Edwards.

25. Simplified Graphical Design of Class C Amplifiers-V. V. Merchant.

- 26. Some Methods for Generation of Linear Sweep Voltages-R. Parshad and T. Singh.
- 27. Synthesis of Control Grid Structure for Remote Cut-off Tubes from the Transfer Characteristic-K. Venkataramanan.
- Technique for the Measurement of High Values of 'Q' of Microwave Cavities-J. K. Sinha and S. Sundaram.
- 29. Total Electron Content of the F₂ Layer at Madras during 1959-C. S. R. Rao and Mangal Sain.
- 30. Transistors in Switching Circuits-M. A. Narayanan.
- 31. Transistor Mixer Stage Employing Base Injection-M. V. Joshi.
- Vacuum Tube Application -- Its Importance in Reliability of Electronic Equipment--S. S. Mani.
- 33. Validity of an Approximation to the Magnetoionic Formulae when V>3ve-Y, S. N. Murty.
- 34. Variation of Midday Critical Frequencies with Lunar Age at Madras-S. Rangaswamy.

APPENDIX-III

LIST OF REFEREES :

The following is the panel of referees appointed at the different towns in accordance with Regulation 5(a).

ANDHRA PRADESH :

Shri T. V. Balasubramaniam, Division Engineer (Phones), Hyderabad.

Shri Ganti Subrahmanyam, Professor of Electrical Engineering, College of Engineering, Kakinada.

Prof. V. V. L. Rao, Principal, Government Engineering College, Ananthapur.

DELHI :

Shri S. M. Agarwal, Secretary, Telephone Switching Systems Committee, P & T Directorate, Parliament Street, New Delhi.

Shri S. S. Aiyar, Planning Officer, All India Radio, Akashvani Bhavan, New Delhi.

Brig. M. N. Batra, C/o National Defence College, New Delhi.

Lt. Col. S. S. Bedi, C-123, Defence Colony, New Delhi-

Shri S. R. Bhashyam, Officer-on-Special Duty, P & T, Parliament Street, New Delhi.

Brig. Jaswant Singh, C/o National Defence College, 6 Tees January Marg, New Delhi.

Air Cmdr. K. A. Joseph, Director of Signals, Air Headquarters, Vayusena Bhavan, New Delhi.

Shri M. M. Kini, Director of Planning, Posts & Telegraphs, New Delhi.

Col. P. N. Luthra, 69, Lodi Estate, New Delhi-3.

Shri Rama Kant, Director of Phones, Posts & Telegraphs, New Delhi.

Dr. Saroj Datta, Controller, Radio Construction & Development Unit, Civil Aviation Department, Safdarjung Airport, New Delhi.

Shri M. L. Sastry, Additional Chief Engineer, A. I. R., Broadcasting House, New Delhi. Shri Uma Shankar, Deputy Director General, P & T, Parliament Street, New Delhi.

GUJARAT STATE:

Dr. K. M. Kotadia, Reader in Physics, University School of Science, Gujarat University, Ahmedabad.

Shri S. Pattabhiraman, Engineer-in-Charge, All India Radio, Ahmedabad.

KERALA STATE :

Shri A. G. John, Station Engineer, All India Radio, Trichur.

Shri K. M. Namboodripad, Lecturer, St. Albert's College, Ernakulam.

MADHYA PRADESH:

Shri O. P. Gulati, Station Engineer, All India Radio, Bhopal. Prof. V. V. Sarwate, 1968, Wright Town, Jabalpur.

Lt. Col. K. N. Talwar, School of Signals, Mhow.

MADRAS STATE :

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Shri K. Nageswaran, C/o RESA Company, 3/16, Mount Road, Madras-2.

Shri K. K. Pitchumani, 10, Promonde Road, Tirhchirapalli Cantonment.

Shri B. S. Rau, Managing Director, Hindustan Teleprinter Ltd., Madras.

Prof. S. Sampath, Professor of Electrical Engineering, Indian Institute of Technology, Madras-36.

Prof. K. Sreenivasan, Director, Madras Institute of Technology, Chromepet, Madras.

MAHARASHTRA STATE :

Wg. Cdr. H. Chandra, Base Signal Repair Unit, Indian Air Force, Poona.

Shri S. N. Kalra, Deputy Director General, Overseas Communications Service, Radio House, Apollo Bunder, Bombay.

Shri D. D. Lakhanpal, 29, New Queen's Road, Bombay.

- Shri K. M. Mehta, Engineer-in-Charge, High Power Transmitters, All India Radio, Malad, Bombay.
- Shri M. S. Muthanna, General Manager, Bombay Telephones, Telephone Bhavan, Colaba, Bombay.

Lt. Col. Y. R. Puri, HQ M. & G. Area, Colaba, Bombay.

Shri G. R. S. Rao, National Ekco Radio & Engineering Co. Ltd. Mahaluxmi, Bombay. Prof. M. G. Samant, Department of Electrical Communication, Engineering College, Poona.

MYSORE STATE :

- Prof. S. V. Chandrasekhar Aiya, Head of the Department of Electrical Communication Engineering, Indian Institute of Science, Bangalore.
- Col. K. K. Mehta, Inspectorate of Electronic Equipment, Ministry of Defence, (CGDP), Bangalore.
- Shri N. V. Shenoi, General Manager, Indian Telephone Industries Ltd., Dooravani Nagar, Bangalore.

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Shri A. C. Ghose, Station Engineer, All India Radio, Cuttack,

Shri A. P. Mohanty, Superintendent of Police (Signals), Cuttack.

PUNJAB STATE :

Brig. T. Baretto, Chief Signal Officer, Western Command, Simla. Shri S. S. Kohli, Engineer-in-Charge, All India Radio, Jullundur.

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Shri C. J. Clement, Director of Telegraphs, Lucknow.

- Shri A. K. Ghose, Reader in Line Communication Engineering, Engineering College, Banaras Hindu University, Varanasi.
- Shri C. P. Joshi, State Radio Officer, U. P. Circle, Police Radio Section, Dilkusha, Lucknow.
- Col. P. Madan, Officer Commanding, 509, Army Workshop, Agra.
- Shri Shanti Swarup, Post Master-General, Posts & Telegraphs, Lucknow.

WEST BENGAL :

- Shri A. S. Balasubramaniam, Engineer-in-Charge, All India Radio, Eden Gardens, Calcutta.
- Dr. K. K. Bose, Assistant Professor, Department of Communication Engg., Indian Institute of Technology, Kharagpur.
- Shri C. A. Cornelius, General Manager, Calcutta Telephones, Telephone Bhavan, 34, Dalhousie Square, Calcutta.
- Shri R. R. Juneja, 27, Rowland Road, Calcutta-20.
- Shri Keshava Chandra, Project Officer, All India Radio, Eastern Project Circle, Calcutta. Dr. S. K. Mitra, F. R. S., National Research Professor, Institute of Radio Physics & Electronics, Calcutta University, 92, Acharya Profulla Chandra Road, Calcutta-9.

APPENDIX-IV

List of Books Available with the Library of the Institution

1. Ahrendt & Savant : Servomechanism Practice.

2. Ahrendt & Taplin : Automatic Feedback Control.

3. A. I. P. : Magnetism and Magnetic Materials-4th Conference.

- 4. A. I. P. : Magnetism and Magnetic Materials-5th Conference.
 - 5. Albert : Electrical Fundamentals of Communication.
 - 6. Aidous, W. H. : Thermoionic Vacuum Tubes.
 - 7. Amos, S. W.: Television Engineering (Vol. I to IV).
 - 8. Arguimbau: Frequency Modulation.
- 9. Arguimbau: Vacuum-Tube Circuits and Transistors.
- 10. Arthur Roberts : Radar Beacons.
- 11. Atkinson: Telephony (Vol. I and II).
- 12. Attura: Magnetic Amplifier Engineering.
- 13. Ayres Fray & Jonah : General College Mathematics.
- 14. Bally Gault : A. C. Machinery.
- 15. Bartea, T. C.: Digital Computer Fundamentals.
- 16. Baxandalt, P. J.: Low Cost High Quality Amplifier.
- 17. B. B. C. : Studio Engineering for Sound Broadcasting.
- 18. Beacon : Differential and Integral Calculus.
- 19. Beckenback : Modern Mathematics for the Engineers.
- 20. Bennington T. W. : Shortwave Radio and Ionosphere.
- 21. Ben Zeines : Servomechanism Fundamentals.
- 22. Beranek : Acoustic Measurements.
- 23. Beranek : Acoustics.
- 24. Beranek: Noise Reduction.
- 25. Bernard Lovell: The Exploration of Space Radio.
- 26. Bernstein: Video Tape Recording.
- 27. Bhandarker, K. R.: Elements of Electricity and Electronic Aids.
- 28. Biondi: Transistor Technology (Vol. I and II).
- 29. Black, H. S.: Modulation Theory.
- 30. Bode: Network Analysis and Feedback Amplifier Design.
- 31. Booker: An Approach to Electrical Science.
- 32. Brailsord : Magnetic Materials.
- 33. Brownwell: Theory and application of Microwaves.
- 34. Bruel: Sound Insulation and Room Acoustics.
- 35. Bruinsma, A. H. ; Multivibrator Circuits.
- 36. Bruinsma, A. H. : Practical Robot Circuits.
- 37. Burns and Saunderbs : Feedback Control System.
- 38. Burrell Hadden: High Quality Sound Production and Reproduction.
- 39. Cady: Radar Scanners and Radomes.
- 40. Cage: Theory Application of Industrial Electronics.
- 41. Carnt, P.S.; Colour Television.
- 42. Carroll, J. M.: Design Manual for Transistor Circuits.

43. Carroll, J. M.: Electron Devices and Circuits

44. Carroll, J. M. ; Modern Transistor Circuit.

45. Carson : Principles of Applied Electronics.

46. Cauer, W.: Synthesis of Linear Communication Networks.

47. Chance : Electronic Time Measurement.

48. Chance, B.: Waveforms.

49. Chinn, A. H.: Television Broadcasting.

50. Choudhuri : Engineering Materials,

51. Churchill, R. V.: Complex Variable and Application.

52. Coblenz, A.: Transistors Theory and Application.

53. Cocking, W. T.: Television Receiving Equipment.

54. Cockrell, D.: Industrial Electronics.

55. Colchester, C. D.: Air Traffic Control.

56. Colebrook, F. M.: Basic Mathematics for Radio Engineers.

57. Colomb, M.: Elements of Ordinary Differential Equations.

58. Cote: Linear Vacuum Tube and Transistor Circuits.

59. Cotton, S. J.: Mathematics for Telecommunication Engineering.

60. Cotton and Golding: Foundations of Electrical Engineering (Vol. I and II)

61. Cuccia Louis : Harmonics, Sidebands, Transients in Communication Engineering.

62. Cunningham : Introduction to Non-Linear Analysis.

63. Daniel Levine : Radar Grammetry.

64. Das, P. N.: Line Telegraphy.

65. Davenport and Root : Random Signals and Noise.

66. David Dewitt : Transistor Electronics.

67. Davis : Industrial Electronics Engineering.

68. Davies : Magnetic Tape Instrumentation.

69. Dawes, C. L.: Industrial Electricity (Vol. I and II).

70. Del Toro : Principles of Control System.

71. Deutsch : Theory and Design of Television Receiver,

72. Dover, A. T. : Alternating Currents.

73. Dummer, G. W. A. : Electronic Equipment Design and Cost.

74. Dummer, G. W. A. : Fixed and Variable Capacitor.

75. Dummer, G. W. A. : Miniature and Micro Miniature Electronics.

76. Dummer, G. W. A. : Modern Electronic Components.

77. Eastman: Fundamentals of Vacuum Tubes.

78. Eberhard Spenke : Electronic Semiconductors.

79. Edward Hughes : Fundamentals of Electrical Engineering.

80. Egon Brenner : Analysis of Electric Circuits.

81. Elie J. Baghdady : Lectures on Communication System Theory.

82. Emeleus, K. G.: The Conduction of Electricity through Gases.

83. Ernest Frank : Electrical Measurement Analysis.

84. Ettinger, G. M. : Magnetic Amplifiers.

85. Evans : Control System Dynamics.

86. Fairweather : Quartz-Crystals as Oscillators and Resonators.

87. Feinstein : Foundation of Information Theory.

88. Fink : Television Engineering.

89. Fitchen, F. C. : Transistor Circuit Analysis and Design.

90. Fitzgerald, A. E. : Basic Electrical Engineering.

91. Flint, H. T. : Wave Mechanics.

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- 92. Freebody, J. W. : Telegraphy.
- 93. French & Vierck, J. : Fundamentals of Engineering Drawing.
- 94. French & Vierck, J. : A Manual of Engineering Drawing.
- 95. Frost Smith, E. H.: The Theory and Design of Magnetic Amplifiers.
- 96. George J. Hood : Geometry of Engineering Drawing.
- 97. Geppert : Basic Electron Tubes.
- 98. Geyger, W. A.: Magnetic Amplifier Circuits.
- 99. Glasford, C. M.: Foundation of Television Engineering.
- 100. Glasford, C. M.: Fundamentals of Television Engineering.
- 101. Glasoe : Pulse Generator.102. Golding : Electrical Measurements and Measuring Instruments.
- 103. Goldsmid : Application of Thermoelectricity.
- 104. Gordon, Newstead : General Circuit Theory.
- 105. Gottlib, I.: Basic Pulses.
- 106. Granino Akorn: Mathematical Handbook.
- 107. Gray, L. F.: Radio Transmitters. 108. Gray, T. S.: Applied Electronics.
- 109. Greenwood : Electronic Instruments.
- 110. Griffith, B. W.: Radio Electronics Transmission Fundamentals,
- 111. Grob-Bernard : Basic Electronics.
- 112. Hague, B.: An Introduction to Vector Analysis.
- 113. Hamilton, J. J. : Reflex Klystron.
- Hamilton, : Klystrons and Microwave Triodes.
 Hammond : Electrical Engineering.
- 116. Harrington : Introduction to Electromagnetic Engineering.
- 117. Harris, M. Cyril : Handbook of Noise Control.
- Harry Lass : Elements of Pure and Applied Mathematics.
 Hammerling, E. M. : Mathematical Analysis.
- 120. Hencock : Introduction to Principles of Communication Theory.
- 121. Henny : Radio Engineering Handbook.
- 122. Henny, K.: Reliability Factors for Ground Electronic Equipment.
- 123. Henny & Walsh : Electronic, Component Handbook Vol. I, II, and III.
- 124. Hill, W. R.: Electronics in Engineering.
- 125. Holmes: Trigonometry.126. Hughes, B.: Alternating Current Bridge Methods.
- 127. Hunter, L. P.: Handbook of Semiconductor Electronics.
- I. S. I. Handbook of Quantities, Conversion Factors, Formulae and Tables.
 I. I. & T. Corpn.: Reference Data-Radio Engineers.
 Ivall, T. E. : Electronic Computers.

- 131. Jackson : Analog Computation.
- 132. Jackson : High Frequency Transmission Lines.
- 133. Jackson : Wave Filters.
- Jacob, L.: Electron Optics.
 Jacob, Millman: Vacuum Tube and Semiconductor Electronics.
- 136. Jaeger : An Introduction to Laplace Transformation.
- 137. James : Theory of Servomechanism.
- James Muir : High Quality Sound Reproduction.
 Jensen/Chenoweth : Applied Engineering Mechanics.
- 140. Jhonson : Transmission Lines and Networks.
- 141. John S. Hall: Radar Aids to Navigation. 142. Johnson: Analog Computer Techniques.
- 143. Johnstone : Frequency Modulation.

- 144. Jolly : Telegraph Transmission Theory.
- 145. Jolly Tagg: Electrical Measuring Instruments.
- 146. Jones: Ionization and Breakdown in gases.
- 147. Jones, D. D.: Transistor A. F. Amplifiers.
- 148. Jordon E. C. : Electromagnetic Waves and Radiating System.
- 149. Joseph, H. J. : Heaviside Electric Circuit Theory.
- Karplus, W. J. : Analog Simulation.
 Keister : The Design of Switching Circuit.
- 152. Kerkhof, F.: Television,
- 153. Kerr: Propagation of Short Radio Waves.
- 154. King : Transmission Line Theory. 155. Kiver: Colour Television Fundamentals.

- Kraus: Antennas.
 Kuh, A. W. : Frequency Modulation.
 Kuh, S. K. : Principles of Circuit Synthesis.
- 159. Ladner & Stoner : Shortwave Wireless Communication.
- 160. Landu, W. R. : Electronic Designers.
- 161. Lamont : Wave Guides.
- 162. Langford Smith: Radio Design Handbook.
- 163. Langmuir : Foundations of Future Electronics.
- 164. Laport : Radio Antenna Engineering.
- Lathan : Magnetron.
 Lawrence M, Graves : Theory of Functions of Real Variables.
- 167. Lawson Uhlenbeck : Threshold Signals.
- 168. Leondes : Computer Control Systems Technology.
- 169. Lepage, W. R.; Analysis of A. C. Current.
- 170. Lepage, W. R. : General Network Analysis.
- 171. Low, D. A.: Applied Mechanics
- 172. Lynch & Truxal: Principles of Electronic Instrumentation.
- 173. Luzadder, W. J.: Fundamentals of Engineering Drawing.
- 174. Mark: Basis of Phototubes and Photocells.
- Markus & Zeluff: Electronics for Engineers. 175.
- 176. Marrows, H. E.: Transistor Engineering Reference Handbook.
- 177. Mason : Elec-mechanical Transmission and Wave Filters.
- 178. Mason: Piezo-Electric Crystals.
- 179. Mason: Physical Ac and Properties of Solids.
- 180. Michael Rettinger : Practical Electroacoustics.
- 181. Middleton: Introduction to Statistical Communications Theory. 182. Miller, W. E.: Television Explained.
- 183. Miller, W. E. : Radio Circuits. 184. Millman : Electronics.
- 185. Mischa Schwartz: Information, Transmission, Modulation and Noise,
- 186. Mitra, S. K.: The Upper Atmosphere.
- 187. Morley: Mechanics for Engineers.
- Murphy, J. G. : Basic Automatic Control Theory. 188.
- 189. Neeteson, P. A.: Analysis of Bistable Multivibrator Operations
- 190. Newell : Vector Analysis
- 191. Olson, H. F.: Acoustical Engineering.
- 192. Page: Principles of Electricity.
- 193. Page, H. C. : The Algebra of Electronics.
- 194. Palmer & Miser : College Algebra.

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- 195. Parkinson, A. C.: Intermediate Engineering Drawing.
- 196. Parr, G. and Davie, O. H. : Cathode Ray Tube and its Application.
- 197. Penning, F. M.: Electrical Discharges in Gases.
- 198. Pettit : Electronic Amplifier Circuits.

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- 199. Philips Technical Library : Electronic Tubes (Industrial).
- 200. Philips Technical Library : Tables for Computers.
- 201. Philips Tech. Library : U. H. F. Tubes for Communications & Measuring Equipment.
- 202. Pierce, J. A. and Loran L. R. : Navigation, 203. Pierce, J. R. : Travelling Wave Tubes.
- 204. Pipes, L. A.: Applied Mathematics for Engineers and Physicists.
- 205. Plonsey : Principles and Applications of Electromagnetic Fields.
- 206. Poorman : Applied Mechanics.
- 207. Porter : Introduction to Servomechanism.
- 208. Pound : Microwave Mixers. 209. Rapson : Radio Engineering Problem.
- 210. Ratcliff, J. A. : The Physical Principles of Wireless.
- 211. Rayleigh, J. W. S.: The Theory of Sound (Vol. I and II).
- 212. Reich: Theory and Applications of Electron Tubes.
- 213. Reich, H. J.: Functional Circuits and Oscillators.
- 214. Reintjes, J. F.: Principles of Radar. 215. Reyner: Cathode Ray Oscilloscope.

216. Reza, Samual Seely : Modern Network Analysis.

- 217. Rhodes, Donald R.: Introduction to Monopulse.
- Richard, K. M.: Travelling Wave Engineering.
 Richard, L. Bean: Transformers for the Electric Power Industry.
 - Rider and Uslan : F. M. Transmission and Reception.
 - 221. Ridenour : Radar System Engineering.
 - 222. Rose, W. N.: Mathematics for Engineers (Vol. I and II).
 - 223. Rossberg, E. A.: Teleprinter Switching.

 - 224. Rosskoff: Mathematics. 225. Royal Signals: Handbook of Line Communication Vol. I.
- 226. Ryder, J. D. : Engineering Electronics.
- 227. Sandemann, E. K.: Radio Engineering (Vol. I and II).
 228. Samuel Seely: Radio Electronics.
- 229. Samuel Seely : Electron Tube Circuits. 230. Samuel Seely : Electronic Engineering.
- 231. Samuel Seely : Introduction to Electromagnetic Fields.
- 232. Sandretto: Electronic Aviation Engineering.
- 233. Savant, C. J. : Basic Feedback Control System Designs.
- Say, M. G.: Magnetic Alloys and Ferrites. Schonland, F. J.: Atmospheric Electricity. 234.
- 235.
- 236. Scroggie, M. G.: Foundations of Wireless.
- 237. Scroggie, M. G.: Radio and Electronic Laboratory Handbook.
- 238. Schwartz : Information, Transmission, Modulation and Noise.
- 239. Shea: Transmission Networks and Wave Filters.
- 240. Shepherd, A. A.: An Introduction to the Theory and Practice of Semiconductors.
- 241. Shive, J. N. : Semiconductor Devices. 242. Shockley, W : Electronics, Holes and Semiconductors.
- 243. Shrader : Electronic Communication.
- 244. Siskind : D. C. Machinery.
- Siskind : Eelectrical Engineering.
 Skilling, H. H. : Transient Electric Circuits.
- 247. Slot, D.: From Microphone to Ear.

- 248. Smith, S. P.: Problems in Electrical Engineering.
- 249. Smith & Widenbeck : Electrical Measurement, 250. Snel, D. A. : Magnetic Sound Recording.
- 251. Soisson, H. E.: Electronic Measuring Instruments.
- 252. Sokolnikoff: Advanced Calculus.
- 253. Sokolnikoff, I. S. & E. S. : Higher Mathematics for Engineers and Physicists. 254. Soller : Cathode Ray Tubes.
- 255. Stanley : Shortwave Propagation.
- Starr, A. T.: Electronics. Starr, A. T.: Generation, Transmission and Utilization of Electrical Power. 256. 257.
- 258. Starr, A. T.: Television.
- 259. Stephens: Radio Interference Suppression.
- Stevenson, W. D. : Elements of Power System Analysis.
 Still & Siskind : Elements of Electrical Machine Design.
- 262. Stoner, J. E.: Passive Network Synthesis.
- 263. Stratton: Electromagnetic Theory.
- 264. Strauss : Wave Generation and Shaping.
- 265. Sturley, K. R.: Radio Receiver Design (Vol. I and II).
- 266. Sunde, : Earth Conduction Effect in Transmission System.
- 267. Sutton, O. G.: Atmospheric Turbulance.
- 268. Spangenberg, K. R. : Fundamentals of Electron Devices.
- Spangenberg, K. R.: Vacuum Tubes.
 Spreadbury: Television Receiver Servicing. 269.
- 271. Spreadbury, F. G.: Electronic Measurements and Measuring Instruments.
- 272. Teeddbury, C. A.; Basis of Induction Heating (Vol. I and II).
- 273. Terman: Electronic and Radio Engineering.
- 274. Terman and Pettite: Electronic Measurements.
- 275. Thaler & Brown : Analysis and Design of Feedback Control System.
- 276. Thompson: A. C. and Transient Circuit Analysis. 277. Tou, T.: Digital and Sampled Data Control System.
- 278. Truxal, G. J.: Control System Synthesis.
- 279. Truxal, J. G.: Control Engineering Handbook.
- 280. Uda, Shintaro : Yagi-Uda Antenna.
- 281. Van der Ziel: Noise.
 282. Van Valkenburgh: Basic Synchros and Servomechanism.
 283. Vigourees, P.: Ultrasonics.
- 284. Voorhove, N. A. J.: Low Frequency Amplifications,
- 285. Waldron, R. A. : Ferrites, 286. Ware and Reed : Communication Circuits.
- 287. Welch: Wave Propagation Antennas.
- 288. Wellard, C. L. : Resistance and Resistors.
- 289. Wentworth, J. W.: Colour Television Engineering.
- 290. Westinghouse Electric Corporation : Industrial Electronics Reference Book.
- 291. Williams and Young : Electrical Engineering.
- Windred, G.: Elements of Electronics. 292.
- 202
- Wireless World : Guide to Broadcasting Stations. Wireless World : Guide to Broadcasting Stations_1956-57. 294.
- 295. Wireless World; Guide to Broadcasting Stations-1958-59.
 - 296. Wireless World: Trader Year Book (1956 to 1962).
 - Wireless world : Radio Valve Data. 297.
 - 298. Zeluff and Markus: Electronic Manual of Radio Engineers.

APPENDIX-V

List of Journals Received in Exchange of the Journal of the Institution.

- 1. A. T. E. Journal, Automatic Telephone and Electric Co., Strowger Works, Liverpool.
- 2. A. W. A. Technical Review, Amalgamated Wireless Australasia. 554, Parramatta Road, Ashfield, New South Wales.
- Actr Polytechnica Scandinavica (Formerly : Acta Polytechnica)—Scandinavian Council for Applied Research. Stockholm 5.
- 4. Aerial-Marconi's Wireless Telegraph Co. Ltd. Marconi House, Chelmsford, Essex.
- 5. Alta Frequenza-Associazione Electrotecnica Italiana, Via San Paolo 10, Milan.
- Ann. Radioelect Annales de Radioelectricite—Compagnie Generale de T. S. F. Centre d'Information et de Documentation, 12, Rue Carducci, Paris 19.
- 7. Annales de Telecommunication, Centre National d' Etude des Telecommunications Paris.
- Australian Journal of Applied Science, Commonwealth Scientific and Industrial Research Organisation, 314 Albert Street, East Melbourne, C.2. Victoria.
- 9. Australian Journal of Physics. Commonwealth Scientific and Industrial Research Organisation, 314 Albert Street, East Melbourne, C.2. Victoria.
- 10. Bell Laboratories Record, Bell Telephone Laboratories, 463, West Street, New York.
- 11. Bibliography of Scientific Publications of South and South East Asia, National Physical Laboratory, Hillside Road, New Delhi.
- British Communications and Electronics, Heywood & Co. Ltd. Drury House, Russell Street, Drury Lane, London-W. C. 2.
- 13. Brown-Boveri Review-Brown, Boveri and Company Ltd., Baden (Switzerland).
- 14. Bruel and Kjaer Technical Review-Bruel and Kjaer, Naerum, Denmark.
- 15. Bulletin of the All India I. M. D. A., 127, Dadabhai Naoroji Street, Bombay.
- 16. Bulletin of the Institution of Engineers (India). 8, Gokhale Road, Calcutta.
- 17. Cables et Transmission, SOTELEC, 16, Rue de la Baume, Paris 8.
- 18. Communications and Electronics, American Institute of Electrical Engineers, New York.
- 19. E. B. U. Review part A (Technical) and Part B, (General)--Technical Centre of the European Broadcasting Union, 4, Rule de la Vallee, Brussels.
- E. T. J. Japan-Electrotechnical Journal of Japan, Institute of Electrical Engineers of Japan (Denki-Gakai), Yurakucho, Chiyoda-ku, Tokyo.
- 21. Electrical Communication, International Telephone and Telegraph Corporation, 67, Broad Street, New York 4, N. Y.
- 22. Electrical Engineering Abstracts-Institution of Elec. Engineers, Savoy Place, London-W.C.2.
- 23. Electro-Technology, High Grounds, Bangalore.

- 24. Electronic Engineering, Morgan Brothers, 28, Essex Street, Strand, London W. C. 2.
- 25. Electronic Technology, Iliffe and Sons, Dorset House, Stamford Street, London, S. E. 1.
- 26. Electrotechnics, Indian Institute of Science, Bangalore-3.
- 27. Elektrotech. Obzor-Elektrotechnicky Obzor-Krakovska u.c. 8, Prague 2.
- 28. English Electric Journal, English Co. Stafford.
- 29. Ericsson Review, L. M. Ericsson, Stockholm 32.
- 30. G. E. C. Telecommunications, Central Electric Co. Ltd. Telephone, Radio and Television Works, Coventry.
- Geomagnetism i Aerologia (Russian)-The Library of the Academy of Sciences of the USSR, Exchange Department, Leningrad-V. O. 164, Birgevaja Linija-I, U.S.S.R.
- 32. Het PTT-Bedrijf-The Netherlands PTT-Netherlands Postal and Telecommunication Services,
 12. Kortenaekade, The Hague, Netherlands.
- 33. Hewlett-Packard Journal, Hewlett-Packard Co., 257, Page Mill Road, Palo Alto, California.
- Indian Journal of Meteorology and Geophysics, Meteorological Department, Civil Lines, Delhi 8.
- Indian Journal of Physics and Proceedings of the Association for the Cultivation of Science, 2 and 3, Lady Wellington Road, Calcutta.
- Industrial India—All India Manufacturer's Organisation, 4th Floor, Co-Operative Insurance Building, Sir Phirozshah Mehta Road, Bombay.
- 37. Insdoc List, Insdoc, National Physical Laboratory, Hillside Road, New Delhi.
- 38. Ionospheric Data, National Physical Laboratory of India, Hillside Road, New Delhi.
- 39. I. S. I. Bulletin, Indian Standards Institution, 'Manak Bhayan' Road, New Delhi.
- 40. Jodrell Bank Annals (Astronomical Contributions from the University of Manchester) Jodrell Bank Experimental Station, Lower Withinton, Macclesfield, Cheshire.
- 41. Journal of the Acoustical Society of America, American Institute of Physics, 335, East 45th Street, New York-17. N. Y.
- 42. Journal of the Aeronautical Society of India, Aeronautical Society of India, Talkatora Road, New Delhi.
- 43. Journal of the Audio Engineering Society, Post Box No. 12, Old Chelsea Station, New York 11, N. Y.
- 44. Journal of the Franklin Institute, Benjamin Franklin, Parkway at Twentieth St., Philadelphia 3, Pennsylvania.
- 45. Journal of Geophysical Research-5241 Broad Road, Northwest, Washington 15.
- 46. Journal of the Indian Institute of Science, Bangalore.
- 47. Journal of the Institute of Electrical Communication Engineers of Japan, 2-8 Fujimicho Chiyoda-ku, Tokyo.
- 48. Journal of the Institution of Engineers India, 8, Gokhale Road, Calcutta.
- 49. Journal of the Institution of Military Engineers, College of Military Engineering, Kirkee, Poona.
- Journal of the Radio Research Laboratories, Ministry of Posts & Telecommunications, Kokubunji P. O. Kitatama-gun, Tokyo.

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- 51. Journal of Research of the National Bureau of Standards, U. S. Government Printing Office, Washington 25, D. C.
- 52. Journal of Scientific and Industrial Research, Council of Scientific and Industrial Research, Old Mill Road, New Delhi.
- Journal of the Society of Motion Picture and Television Engineers, 55, West 42nd Street New York 36, N.Y.
- 54. Journal of the University of Bombay, Fort, Bombay 1.
- 55. Marconi Review, Marconi's Wireless Telegraph Company, Marconi House, Chelmsford.
- 56. Memoirs of Scientific and Industrial Research, Osaka University, Osaka, Japan.
- 57. New Zealand Journal of Science, Department of Scientific and Industrial Research, Post Box No. 8018, Wellington.
- 58. Noise Control, Published for the Acoustical Society of America by the American Institute of Physics, 335, East 45th Street, New York, 17, N. Y.
- Onde Electrique, 1' Onde Electrique, Societe des Radioelectriciens, 10, Avenue Prierre Larousse, Malakoff (Seine).
- 60. Pakistan Journal of Science, Pakistan Association for the Advancement of Science, University Institute of Chemistry, Lahore.
- 61. Pakistan Journal of Scientific Research, Pakistan Association for the Advancement of Science, University Institute of Chemistry, Lahore.
- 62. Philips Technical Review, Philips, Gloeilampenfabrieken, Eindhoven, Holland.
- 63. Philips Telecommunication Review, Philips, Gloeilampenfabrieken, Eindhoven.
- Post Office Electrical Engineers' Journal, Institution of Post Office Electrical Engineers G. P. O. 2-12, Gresham Street, E. C. 2.
- 65. Proceedings of the Cambridge Philosophical Society, Free School Lane, Cambridge.
- 66. Proceedings of the Institution of Electrical Engineers-Part B (Radio and Electronic Engineers), Savoy Place, London W. C. 2.
- Proceedings of the Institution of Radio Engineers Australia, Science House. Gloucester Street, Sydney.
- 68. Q. S. T. American Radio Relay League, 38, La Salle Road, West Hartfort, Connecticut.
- 69. R. C. A. Review, Radio Corporation of America, R. C. A. Laboratories Division, Princeton, New Jersey.
- 70. Radio Man, Radio Place, Chandni Chowk, Delhi.
- 71. Radio Television, Radio Place, Chandni Chowk, Delhi,
- 72. Radio Times of India, 27 New Queen's Road, Bombay.
- 73. Rundfunktechnische Mitteilungean, Institute für Rundfunktechnik, Mittelweg 113, Hamburg 13,
- 74. Revista Electrotecnia, Association Argentina de Electrotecnicos, Posadas 1657, Buenos Aires.
- 75. Revista de Telecommunication, Consejo Technico de Telecommunication, Palacio de Communicaciones, Madrid.
- Rozprawy Elektrotechniczne. Panstwowe Wydawnictwo Naukowe, Krakowskie Prazedmiescie 79, Warsaw.

- 77. Science and Engineering-Indian Society of Engineers, 12-B, Netaji Subahas Road, Calcutta-1.
- 78. Sdelovaci Technika Krakovska 8, Prague II (Czechoslovakia).
- 79. Slaboproudy Obzr, Krakovska 8, Prague II.
- 80. Sound Recording and Reproduction 3, Coombe Gardens, New Malden, Surrey.
- Technical Journal of Japan Broadcasting Corporation-NHK (Japanese) Japan Broadcasting Corporation, Tokyo (Japan).
- 82. Technische Mitteilungen P. T. T., Schweizerische Post-Telegraphen und Telephon Verwaltung, Speicher gasse 6 Bern.
- Technical News Bulletin-National Bureau of Standards, U. S. Department of Commerce, Washington-25, D. C.
- 84. Telecommunications, Ridge Road, Jabalpur.
- Telecommunication Journal of Australia, Telecommunication Society of Australia, Box No. 4050, G. P. O., Melbourne, Victoria, Australia.
- Telonde'-Compagnie Generale de Telegraphie San Fil, 79, Boulevard Haussman, Paris -8 (France).
- 87. U. S. R. I. Information Bulletin, 7, Place Emile Danco, Brussels.
- 88. Wireless World, Iliffe and Sons, Dorset House, Stamford Street, London S. E. 1,