

Use
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Sec. II-27-60,004-17-11-48.

E.P.H. (1949) Department.

Ms SERIES.

G.O. NO. 2845 Edm.

Dated

10.9.49

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OK 15

[Despatch Abstract.]

College Engg. Shortening B.E. degree
Course - 3 years - Addressing
Universities the paper Research

Back Papers.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

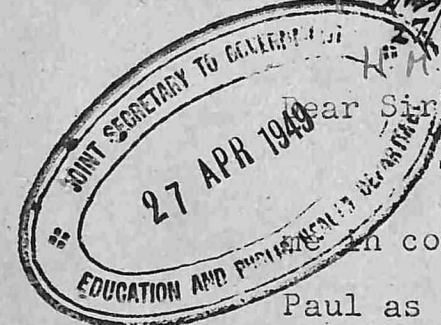
Further Papers.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

Secy., L.P.H.

This may be done
early.

66, Lloyd Road, Royapettah,
Madras, dated the 25th April 1949.



H.A. (Edn.)

Dear Sir,

The enclosed draft has been made by
in consultation with M/s. G.Sundaram and
Paul as directed in the Resolution of the
Board of Technical Education. I have to issue
it with a copy of the syllabus to all the
universities in India and to Governments and
other institutions. The syllabus was printed
by the University but Mr. Paul has been unable
to get copies. So that has also to be printed.
I request that 100 copies of the letter and
100 copies of the syllabus may be printed and
supplied to me for issue.

Yours sincerely,

N. Govindarajan
(N. GOVINDARAJAN).

To

The Hon'ble Mr. A.B. Shetty,
Minister for Education,
Fort St. George, Madras.

From

Sri N. Govindarajan, B.A., B.E.,

Member, Standing Advisory Board for

Technical Education Board,

66, Lloyd Road, Royapettah, Madras.

To

1. The Secretary,
Inter Universities' Board, 10-A, Cavalry Lines,
Delhi.
2. The Registrar, University of Madras, Chepauk, Madras.
3. do. Annamalai University, Chidambaram.
4. do. Andhra University, Kakinada.
5. The Registrars of other Universities.
6. The Secretary, Institute of Engineers, Madras.
7. The Secretary to Government,) East Punjab, Amritsar
Education Department.) East Bengal, Calcutta.
) Orissa, Cuttack.
8. The Secretary to Government,) C. Provinces, Nagpur.
Public Works Department) U. Provinces, Alahabad
) Bihar, Patna.
Madras.
9. The Secretary to the Govt. of India)
Education Department.) New Delhi.
do. Works, Mines & Power)
10. The Secretary to Government,) Mysore.
Education Department.) Hyderabad
Public Works Dept.) Travancore.
Industries Dept.) Baroda
Bopal.
Jaipur.

Sir,

[Subject: Reduction of the undergraduate course
in Engineering from four to three years in
the Colleges in Madras Province.]

I am desired by the Standing Advisory Board for
Technical Education of the Government of Madras to address
this letter to you advocating early substitution of a three
year undergraduate course in Engineering in place of the
existing four year course in the Colleges in India. This
body has the Hon'ble Minister for Education as its President

and as Members the Chief Engineers of the Madras Government, Chief Engineers of the M. & S.M. and S.I. Railways, some members of the Madras Legislatures, the Director of Public Instruction, Principals of the Engineering Colleges in the Madras Presidency under the Madras, Andhra and Annamalai Universities, a representative of the Madras, Andhra and Annamalai Universities, the Director of Industries, and some representatives from the major industries. Such a step to reduce the period is recommended for the reasons discussed below and I shall be grateful if the matter is taken up for active consideration. by the Inter University Board
your University
the Institute of Engineers
your Government.

It has been felt for some years in Madras Province that to provide enough number of engineers to carry out the urgent postwar reconstruction programmes in hand, new colleges were urgently necessary and four new ones were accordingly started ^{Since} in 1945. Examination of the syllabus for the engineering course indicated that it included some items which had been covered already in the Intermediate course and were hence unnecessary. On the other hand, some very desirable subjects like Engineering Economics did not find a place in it. Furthermore it was felt that there were far too many holidays and that it was possible by reducing the number of holidays to curtail the four year course to three years without loss of efficiency.

On examining the practice in other countries it was found that in 22 Universities out of 23 for which information was available, the normal Engineering course after matriculation was only three years and only 6 Universities had four year course - vide Annexure 1. Qualification for admission into the Engineering Course in India is a pass in the Intermediate Examination and this is considered at least equal to if not superior in standard to

London or other foreign Matriculation examination. So there appeared no reason why a longer course than three years should be required in India.

Also in a poor country like ours it is extremely desirable to limit the period of professional course to what will be necessary to secure the desired standard and quality of education. Such a step will not only result in economy to the State but will also minimise the cost to the student and his parent.

A committee formed under the auspices of the Technical Educational Board went deeply into this question and recommended the reduction of the course from 4 to 3 years and also framed a suitable syllabus and in doing so provided 130 working days in the year against the present 160 working days. It was its carefully considered opinion that the revised syllabus in which were omitted certain unnecessary items and were added some new subjects like Engineering Economics and Writing of Reports was adequate for the Degree course and could be completed within three years without any impairment of efficiency or strain on the students.

The Committee further recommended that with a view to provide the highest possible instruction in Engineering, a post graduate course of one year leading to M.Sc. degree should also be instituted, in addition to the existing M.Sc. degree obtainable by submission of thesis. It also recommended that facilities should be provided in the Engineering Colleges for research leading to M.Sc. and Doctorate Degrees in Engineering. In the meeting of the Standing Advisory Board for Technical Education of the Government of Madras held on 1st December 1948 the resolution to shorten the existing 4 year engineering course to three years was put to the vote and carried by an overwhelming majority. The Board of Studies of the Madras University also examined these proposals, accepted them and vetted the three year syllabus to be in consonance with the rules and regulations

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of the University of Madras and put the proposal ~~with~~ up for further implementation. A copy of this syllabus ^{Annexure 2.} is enclosed for your information. In the meeting of the Academic Council of the Madras University, the resolution to introduce the 3-year shortened course instead of the present 4-year course from the academic year 1948-49 was moved by the Secretary of the Standing Advisory Board for Technical Education, Lt. Col. S. Paul and the same was duly seconded. An amendment that the consideration of the three-year course be deferred to the next meeting of the Academic Council to be held in February 1949 was moved by one of the members and was duly seconded. The members had then a chance to express their opinion on the three year course, and there was a considerable discussion in which the majority of the members of the Academic Council took part. The amendment was put to the vote and carried.

At this stage, the Board of Technical Education finds its labour in this respect is likely to be frustrated by the view taken up by the Academic Council of the Madras University and at its meeting held in February 1949 and by a possible erroneous interpretation of a Resolution of the Inter Universities Board. To quote this Resolution and to reproduce what appeared in the papers about the Academic Council's discussion and view.--

(1) Resolution of the Inter Universities Conference.--

"This Conference is of opinion that the minimum period of training for a degree in Engineering should not be less than 4 years but during the course, periods of practical training may also be included."

(2) Extracts from the "HINDU" dated 19th February, 1949 p.5 - Amending Madras 'Varsity Act - Academic Council's discussion.

B.E. Degree course.

"Mr. T. Totadri Iyengar moved that no change be made at present in the regulations governing the B.E. Degree course. He stated that the suggestion for the reduction of the period of the degree course in Engineering from four to three years came up on the recommendation of the Standing Advisory Board for Technical Education of the Government of Madras. The Board of Studies in Engineering of this University considered the suggestion and resolved to reduce the course from four to three years and framed the necessary regulations and syllabuses. Meanwhile the Standing Committee of the Academic Council considered the resolutions passed by the Inter Universities' Conference on the subject. The Conference was of opinion

that there should be uniformity in regard to the duration of the Engineering Degree course in the Universities. It also expressed the opinion that the minimum period of training for a degree in Engineering should be not less than four years, but, during this course, periods of practical training might be included. Should the practical training be not included or be not sufficient an additional period of practical training of not less than 180 days should be required after the candidate had finished his four-year degree course. Mr. Totadri Iyengar stated that in almost all the Universities in India the period of the course was four years. Only in three Universities, namely Aligarh, East Punjab and Osmania Universities they had three year courses. It had been found that in America and in some other countries, the minimum period of training was four years. It was thought that the reduction of the course might lead to the lowering of the standard. He said that there had been constant changes in the syllabus for the degree course, and he felt that, in view of the resolution passed at the Inter-University Conference it was not advisable to reduce the period of the course.

Mr. G. R. Narayana Aiyar seconded the motion.

Need for Uniformity.

The Acting Vice-Chancellor stated that the Inter Universities Conference thought it desirable to have uniformity in regard to the duration of the course. An expert committee considered the matter. By passing the resolution moved by Mr. Totadri Iyengar, they were not completely shelving the question. The Vice-Chancellor had told him that he intended to convene a conference very soon of representatives of the various engineering institutions for the purpose of further examining the details, as there was need for ~~training~~, ~~for~~, ~~more~~ ~~training~~ more men in this profession. The details would be considered then and, if a change was necessary, it would be brought up again.

Lt. Col. S. Paul said he was in favour of having a three year course. The present course was a four year course without any practical training. The profession was a growing one and the syllabuses had to be changed often if they should be abreast of the times. The need for a greater number of engineers was keenly felt and the course could be reduced without impairing the efficiency of the course. He was sure that with a shorter period, the standard of instruction would be better. The suggestion to have a shorter course was made by the Scientific Man Power Committee of the Government of India, to meet the growing needs of the country and the All-India Council of Education had also approved it. As one connected with teaching the subject, he would say that a lot of unnecessary things were being taught to students now. With increased number of working days and with useful subjects, the course could be reduced to three years without risk of lowering the standard of efficiency.

Mr. P. Mahadevan stated that the resolution before the House was not definite. He could not understand whether the four year course suggested by the Inter Universities Conference included practical training or not. He was also of the opinion that the course could be shortened, if suitable candidates were selected for the course.

Practical Training.

The Acting Vice-Chancellor stated that the question of fitting in the period of practical training within the four-year period would be considered by the Conference to be convened.

Mr. P. R. Ramaswami said that by reducing the period of the course, the standard would not be affected. Practical training was the most important part in training, and what they had to teach by way of principles in classes could be done within a limited period.

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Mr. Mathews Tharakan doubted the wisdom of reducing the course to three years.

Mr. K. Balasubramania Aiyar asked whether it would be possible to produce efficient engineers in a shorter course than at present.

Lt. Col. S. Paul stated that engineering could best be learnt in the field and not in classes. He thought that, by having a three-year course, they could meet the exigencies of the service in the country.

After some more discussion, the motion of Mr. T. Totadri Iyengar that no change be made for the present in the regulations governing the B.E. Degree course was passed, 43 voting for and 14 against the motion."

1/10 The case for shortening the course can be summed up as follows.--

2/10 (1) It is certified by all the Members of the Engineering profession including the Principals and Professors of all the Engineering Colleges in this Province that the shortening of the course to 3 years worked along with the revised syllabus and the increase in teaching hours will not result in the lowering of the standard. All that the Board has done in revising the syllabus is to weed out some of the routine and mechanical features found in the old syllabus and to add a few.

(2) The Technical Man-Power Committee of the Government of India asked that the 4 year degree course of Engineering Colleges should be shortened to 3 years. This Standing Advisory Board for Technical Education would ask that its recommendation in favour of shortening the course should be read together with its other recommendations for instituting M.Sc. and Doctorate Degrees. The proposals form an integrated unit. The Board is assured that while the B.E. degree will retain its standard unimpaired the larger scope allowed for M.Sc. and Doctorate degrees will produce men who will unlike in the past, take research as a life long career and contribute to the advancement of the country in Engineering and other industries.

The Board finds that the resolutions of the Inter Universities Conference is not opposed to the view of this Board. That resolution seeks to include in a 4 year course periods of practical training also. Such practical training

2-11/11-26 ans
-6-
had extended in the past over 1 year. The best method in which both the Board's Recommendation and the Resolution of the Inter Universities Conference can be implemented is.--

3/12 (a) To reduce the Academic Course to 3 years at the end of which the candidates can sit for the B.E. Degree Examination.

(b) To permit the successful candidates to take employment under recognised engineering trades and industries and to award them the B.E. Degree on the completion of a year's satisfactory training.

1/10 Practical course has nowhere been defined. There is a fundamental difference between a practical course which Engineers can undergo and the apprentice course which Mechanics and artisans should get through.

In the opinion of the Board, the practical course for engineers should aim at giving general training in the method of application of theory to practice, while apprenticeship for mechanics and artisans should give specialised manual training in handling machines and machine tools. It should be evident therefore that Engineers who may have to deal with varying problems in their Engineering life can only acquire a general training in the art of applying theory to practice in a practical course extending over only one year. They cannot become specialists with a year's training either in Irrigation or in building construction or in prime movers, or in Power Engineering. It is also the experience of Engineers that no student who is not made responsible for his work and who does not earn a stipend or pay during the practical course really learns anything useful. The so called practical course for Engineers must therefore virtually mean the training that they get in the first year of their employment.

The Board therefore makes the following suggestions.--

2/12 (1) The Academic course for a B.E. Degree should be over a 3 year period each year with 180 teaching hours as against 160 hours at present.

(2) The B.E. Degree examination should be held at the end of the 3 year course.

(3) The B.E. Degree might be awarded to the successful students if they have satisfactorily completed an year's employment under a recognised engineering employer. This would meet the requirements of the Inter Universities' Resolution.

The Board requests the Universities in India and the Inter Universities' Conference to consider these suggestions and initiate steps for their implementation and also if convenient keep me informed of the further steps that may be taken.

If you desire further information, the Board will be glad to furnish it on hearing from you.

Yours sincerely,

(N. GOVINDARAJAN).

Encls: Annexure I - List of foreign Universities with 3 year and 4 year engineering courses.

Syllabus for the three years course.

1-2- ✓ ✓ ✓ 10/6
3, 4, 6, 9, 10. Mr. Smith
11, 12, 14 - E. Parthasarathy
5 - Mr. Smith
7, 8 - Mr. Smith
11-13 - Mr. Smith
14-16 - Mr. Smith

16/2
Annexure I
11

DURATION OF ENGINEERING DEGREE COURSES
IN THE UNIVERSITIES IN THE UNITED KINGDOM, UNITED STATES OF AMERICA AND OTHER COUNTRIES.

Sl. No.	Name of country.	Name of University or College and duration of course.		Remarks.
		3 Years.	4 Years.	
	United Kingdom.	(1) Aberdeen (2) Belfast ** (3) Glasgow ** (4) St. Andrew. 5) Edinburgh ** (6) Sheffield 7) Leeds 8) Liverpool 9) London ** (10) Durham 11) Manchester.	(1) Imperial College of Technology, London.	
	United States of America.	12) New York 13) Columbia 14) California	2) Massachusetts Institute of Technology. 3) Carnegie Institute of Technology.	
	Canada	15) Alberta 16) Manitoba 17) Queens	4) Saskatoon	
	Australia	18) Adelaide 19) Melbourne 20) Queensland 21) Sydney		
	New Zealand		5) New Zealand	
	South Africa	22) Rhodes	6) Cape Town	

** Note: Items 3, 4, 6, 10 have also an honours course extending over 4 years.

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To Sri. N. Govinda Raja Iyengar
Chairman
Special Council

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APPENDIX KK.

Revised Regulations for the B.E. Degree.

Degree of Bachelor of Engineering.

1. Candidates for the Degree of Bachelor of Engineering shall be required to have passed the Intermediate Examination in Arts and Science in this University with Physics, Chemistry and Mathematics as optional subjects or an examination in some other University accepted by the Syndicate as equivalent thereto and subsequently to have attended a constituent or an affiliated college of Engineering for a period of not less than three academic years. They shall be further required to have passed the B.E. Degree Examination.

Scheme of Examination.

2. There shall be three examinations in Engineering leading to the final Degree viz.,

- (a) First B.E. Examination.
- (b) Second B.E. Examination.
- (c) Final B.E. Examination.

The above examinations shall be both written and practical as under and shall be held at the end of the First, Second and Third academic years respectively.

Ananda Press, Madras—10-9-1948—300 Copies.

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FIRST B. E. EXAMINATION.
(Common to Civil, Mechanical, Electrical and
Tele-communication Branches).

Part I (Written).

No. in Syllabus.	Subject.	Maximum Marks.
1.	Mathematics I	100
2.	Physics	100
3.	Chemistry	100
4.	Applied Mechanics	100
5.	Civil Engineering	100
6.	Mechanical Engineering	100
7.	Electrical Engineering	100
8.	Surveying	100
9.	Geometrical Drawing	100
10.	Machine Drawing and Design I	100
		1,000

Part II (Practical).

Physics Laboratory	50
Chemistry Laboratory	50
Electrical Engineering Laboratory	75
Surveying	100
275	

Part III (Sessional Work).

Physics Laboratory	25
Chemistry Laboratory	25
Graphic Statics	25
Building Drawing	25
Machine Drawing and Design	25
Geometrical Drawing	25
Electrical Laboratory	25
Surveying	25
Workshops	25
225	

Total ... 1,500

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SECOND B. E. EXAMINATION.

(CIVIL BRANCH)

Part I—(Written)

No. in Syllabus.	Subject.	Maximum Marks.
11.	Mathematics II	100
12.	Do. III	100
13.	Strength of Materials and Theory of Structures	100
14.	Hydraulics	100
15.	Structural Engineering I	100
16.	Railway and Highway Engineering	100
17.	Surveying	100
18.	Engineering Geology	100
19.	Quantity Surveying and Cost Analysis I.	100
20.	Building Drawing	100
		1,000

Part II—(Practical)

Strength of Materials Laboratory	100
Hydraulic Laboratory	100
Surveying	50
250	

Part III—(Sessional Work)

Graphic Statics	25
Strength of Materials Laboratory	25
Hydraulic Laboratory	25
Building Drawing	25
Structural Engineering Drawing	25
Bridge Drawing	25
Geology Laboratory	25
Quantity Surveying and Cost Analysis I	25
Surveying	25
Workshop	25
250	

Total ... 1,500

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SECOND B.E. EXAMINATION
(MECHANICAL BRANCH)
Part I—(Written).

No. in Syllabus.	Subject.	Maximum Marks.
11.	Mathematics II	... 100
12.	Do. III	... 100
32.	Applied Mechanics and Elements of Structural Engineering	... 100
14.	Hydraulics I	... 100
33.	Heat Engines I	... 100
34.	Auto Engineering	... 100
35.	Electrical Technology	... 100
36.	Machine Drawing and Design II	... 100
20.	Building Drawing	... 100
		900

9

Part II—(Practical).

Mechanical Engineering Laboratory ...	100
Strength of Materials Laboratory ...	75
Workshops ...	100
Surveying ...	75
	350

Part III—(Sessional Work).

Graphic Statics	...	25
Machine Drawing and Design II	...	25
Building Drawing	...	25
Mechanical Engineering Laboratory	...	50
Strength of Materials Laboratory	...	25
Hydraulic Engineering Laboratory	...	25
Electrical Engineering Laboratory	...	25
Survey	...	25
Workshops	...	25
		250
	Total	... 1,500

16 1/2
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26 mms
17

SECOND B. E. EXAMINATION.
(ELECTRICAL BRANCH)
Part I—(Written.)

No. in Syllabus.	Subject.	Maximum Marks.
11.	Mathematics II	... 100
12.	Mathematics III	... 100
32.	Applied Mechanics and Elements of Structural Engineering	... 100
14.	Hydraulics	... 100
45.	Theory and Calculation of Electrical Apparatus I	... 100
46.	Industrial Electronics	... 100
47.	Heat Engines I	... 100
48.	Design and Drawing I	... 100
20.	Building Drawing	... 100
		900

Part II—(Practical)

Electrical Laboratory	... 125
Strength of Materials Laboratory	... 75
Workshops	... 75
Surveying	... 75
	350

Part III—(Sessional Work)

Graphic Statics	...	25	
Design and Drawing	...	25	
Building Drawing	...	25	
Electrical Laboratory	...	25	
Mechanical Laboratory	...	25	
Strength of Materials Laboratory	..	25	
Hydraulics Laboratory	...	25	
Survey	...	25	
Workshops	...	25	
Theory and Calculation of Electrical Apparatus	...	25	
			250
	Total	...	1,500

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SECOND B.E. EXAMINATION
(TELE-COMMUNICATION BRANCH)

10

No. in Syllabus.	Subject.	Maximum Marks.
<i>Part I—(Written)</i>		
11.	Mathematics II	100
12.	Mathematics III	100
56.	Applied Mechanics and Elements of Structural Engineering	100
57.	Engineering Electronics I	150
35.	Electrical Technology I	100
48.	Design and Drawing I	100
47.	Heat Engines	100
20.	Building Drawing	100
		850

4

Part II—(Practical)

Radio Engineering Laboratory	...	150	
Electrical Engineering Laboratory	...	100	
Mechanical Engineering Laboratory	...	75	
Workshops	...	75	400

Part III—(Sessional Work)

Graphic Statics	...	25
Building Drawing	...	25
Design and Drawing	...	25
Radio Engineering Laboratory	...	50
Electrical Engineering Laboratory	...	25
Mechanical Engineering Laboratory	...	25
Strength of Materials Laboratory	...	50
Workshops	...	25
		250

Total ... 1,500

15

HS

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26 ans

FINAL B.E. EXAMINATION.
(CIVIL BRANCH).

No. in Syllabus.	Subject.	Maximum Marks.
<i>Part I—(Written.)</i>		
21.	Advanced Theory of Structures	100
22.	Structural Engineering II	100
23.	Hydraulics and Hydraulic Machinery.	100
24.	Design and Drawing I (Structural)	100
25.	Irrigation Engineering	100
26.	Sanitary Engineering	100
27.	Surveying	100
28.	Quantity Surveying and Cost Analysis II	100
29.	Design and Drawing II (Irrigation and Sanitary)	100
30.	Engineering Economics	50
31.	Report Writing	50
		1,000

Part II—(Practical).

Strength of Materials Laboratory	...	75	
Hydraulics Laboratory	...	75	
Surveying	...	100	
			250

Part III—(Sessional Work).

Graphic Statics	...	25
Structural Engineering Drawing	...	25
Irrigation Drawing	...	25
Sanitary Engineering Drawing	...	25
Quantity Survey II	...	25
Project	...	25
Surveying	...	25
Strength of Materials Laboratory	...	25
Hydraulics Laboratory	...	25
Workshops	...	25
		250

Total ... 1,500

16-17

13-4

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16

FINAL B.E. EXAMINATION.
(MECHANICAL BRANCH.)

Part I—(Written.)

No. in Syllabus.	Subject.	Maximum Marks.
37.	Heat Engines II	100
38.	Electrical Technology II	100
39.	Theory of Machines	100
40.	Hydraulic Machinery	100
41.	Fuels, Gas Plant and Boilers	100
42.	Workshop Practice	100
43.	Machine Design and Drawing III	100
44.	Quantity Surveying and Cost Analysis.	100
30.	Engineering Economics	50
31.	Report Writing	50
		900

Part II—(Practical.)

Mechanical Laboratory	100
Electrical Laboratory	75
Hydraulics Laboratory	75
Workshops	100
350	

Part III—(Sessional Work.)

Theory of Machines	25
Machine Design and Drawing III	50
Quantity Surveying and Cost Analysis.	25
Mechanical Engineering Laboratory	50
Electrical Engineering Laboratory	25
Hydraulic Engineering Laboratory	25
Workshops	50
250	

Total ... 1,500

FINAL B.E. EXAMINATION.
(ELECTRICAL BRANCH.)
Part I (Written).

No. in Syllabus.	Subject.	Maximum Marks.
49.	Heat Engines II	100
40.	Hydraulic Machinery	100
50.	Theory and Calculation of Electrical Apparatus II	100
51.	Electrical Theory and Measurements...	100
52.	Generation and Utilization	100
53.	Transmission and Distribution	100
54.	Design and Estimate of Electric Supply Systems	100
55.	Design and Drawing	100
30.	Engineering Economics	50
31.	Report Writing	50
		900

Part II (Practical).

Electrical Laboratory	125
Mechanical Laboratory	75
Hydraulics Laboratory	75
Workshops	75
350	

Part III (Sessional Work).

Transmission and Distribution	25
Design and Estimate of Electric Supply Systems	25
Design and Drawing II	25
Electrical Engineering Laboratory	75
Mechanical Engineering Laboratory	25
Hydraulic Engineering Laboratory	25
Workshops	25
Theory and Calculation of Electrical Apparatus	25
250	

Total ... 1,500

22

10

84-
26 ans

FINAL B. E. EXAMINATION.
(TELE-COMMUNICATION BRANCH)

No. in Syllabus.	Subject.	Maximum Marks.
<i>Part I—(Written).</i>		
58.	Engineering Electronics II	... 100
59.	High Frequency Measurements	... 100
60.	Transmission Circuits	... 100
61.	Broadcasting (Reception) I	... 100
62.	Broadcasting (Transmission) II	... 100
63.	Wire Communication I (Telegraphy).	100
64.	Wire Communication II (Telephony)...	100
38.	Electrical Technology II	... 100
30.	Engineering Economics	... 50
31.	Report Writing	... 50
		900

Part II—(Practical).

Radio Engineering Laboratory	... 150
Telegraphy and Telephony Laboratory.	75
Electrical Engineering Laboratory	... 75
Workshops	... 50
	350

Part III—(Sessional Work).

Radio Engineering Laboratory	... 50
Telegraphy and Telephony Laboratory.	50
Electrical Engineering Laboratory	... 50
Workshops	... 50
Design and Drawing	... 50
	250
Total	... 1,500

11

23 194-
26 ans

3. Candidates may present themselves for the First, Second and Final Examinations after undergoing the prescribed courses of study for each of the examinations for a period of one academic year in a constituent or affiliated college.

4. Candidates shall be declared to have passed the First, Second and the Final Examinations if they obtain not less than 35 per cent of the marks in each of the written papers (Part I), 40 per cent of the marks in Practical (Part II) in each subject, 40 per cent in the aggregate for Sessional Work for each year and 50 per cent in the entire aggregate for the respective examinations.

5. Candidates who fail in any one of the examinations but obtain 50 per cent of the marks in the aggregate of that examination shall be exempted from re-examination in the subjects in which they have passed as per Regulation 4 and shall be required to pass the examination in the rest of the subjects only.

6. (a) No candidate shall be permitted to sit for the Second B.E. Examination in Engineering unless he has passed his First B. E. Examination in Engineering or has obtained exemption under Regulation 5. (b) No candidate shall be permitted to sit for the Final B. E. Examination unless he has passed the Second B. E. Examination or has obtained exemption under Regulation 5.

7. Candidates who pass the examination on the first occasion of their appearing therefor, and obtain not less than 60 per cent of the total marks shall be placed in the First Class and the rest in the Second Class. Candidates

who pass in the First Class and who obtain not less than 75 per cent in the aggregate shall be deemed to have passed with Honours.

Candidates who pass the First, Second and Final B. E. Examinations at a subsequent appearance or two examinations together shall be ranked separately in the Second Class.

8. All the written examinations shall be of three hours duration. All the practical examinations shall be of three hours duration except the following :—

4 hours for Field Work and 2 hours for Calculation and Plotting for all examinations in Surveying; 4 hours for the Second and Final B. E. Examinations in Mechanical Engineering Laboratory for the Mechanical Branch, Electrical Engineering Laboratory for the Electrical Branch, Radio Engineering Laboratory for the Tele-communication Branch and Workshops for the Electrical and Tele-communication Branches; 8 hours for the Final B.E. Examination in Workshop for the Mechanical Branch.

Transitory Regulations

9. Candidates who are undergoing the courses for the First, Second, Third and Final B.E. Examinations according to the Regulations which came into force in 1947-48 (C), and also those who have completed the course but have not passed all the examinations, will take the examinations for that year and the subsequent years under these Regulations, subject to the following conditions:—

- (a) Candidates who have undergone the course of study for the First B.E. Examination and earned the prescribed certificate of attendance and progress, but did not appear for the

examination, or having appeared for the examination, failed therein, shall be permitted to take the examination under these Regulations till March 1951.

- (b) Candidates who have undergone the course of study for the Second B.E. Examination, but did not appear for the Examination, or having appeared for the Examination, failed therein shall be permitted to complete the examination under these Regulations till March 1952.

- (c) Candidates who have undergone the course of study for the Third B.E. Examination, but did not appear for the Examination, or having appeared for the Examination, failed therein shall be permitted to complete the Examination under these Regulations till March 1953.

- (d) Candidates who have completed the course of study for the Final B.E. Degree Examination, but did not appear for the Examination, or having appeared for the Examination, failed therein shall be permitted to complete the Examination under these Regulations till March 1954.

10. Candidates who have completed the course of study for F. E. Part I, or F. E. Part II, or B. E. Part I, or B. E. Part II Examination under the Regulations in force from 1944-47 (B) but have failed in the examination shall be permitted to complete the examination in March 1949 under those Regulations. Candidates who pass the examination for which they appear in March 1949 shall be permitted to take the next higher examination under the Regulations which came into force in 1947-48, after undergoing the course of study prescribed therefor, wherever necessary. Candidates who fail in the examination for

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which they appear in March 1949 shall thereafter take the corresponding examination under the Regulations which came into force in 1947-48, and shall thereafter be permitted to proceed to the next higher examination after putting in the course of study prescribed for that examination under these Regulations, subject to the time limit imposed in Regulation 9 *supra*.

11. Candidates who have completed the B.E. Degree Course before March 1944 (A), and those who have passed the F.E. Examination according to the Old Regulations in or after 1944 shall be permitted to appear for the B.E. Degree Examination according to the Old Regulations.

This Regulation shall be in force till 1949.

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APPENDIX KK-1.

Revised Syllabus for the B. E. Degree Examination.

First B.E. Examination.

1. Mathematics I.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

1. *Co-ordinate Geometry*.—Simple properties of the circle, Parabola, Ellipse and Hyperbola (in Cartesian and Polar co-ordinates) and easy problems thereon.

2. *Statics*.—Composition and resolution of forces. Moments. Couples. Conditions of equilibrium of forces in one plane. Friction, virtual work, centre of gravity, stable and unstable equilibrium. The common catenary. Light string on a rough curve.

3. *Calculus*—(a) *Differential*. Differentiation of Algebraic, Trigonometric, Exponential, Hyperbolic, Logarithmic and Inverse trigonometric functions. Simple applications of the derivative to Geometry and Mechanics. Approximations and small errors. Theorems of mean value. Maxima and minima of functions of the variable curvature. Partial differentiation.

(b) *Integral*.—Integration of standard forms, Integration by substitution, by partial fractions and by parts. Integration as a process of summation. Areas and lengths of plane curves. Volumes and surfaces of revolution. Centre of gravity. Moments of Inertia. Double integrals.

2. Physics.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Heat.—Gas thermometer, Pyrometers, Electrical resistance, Thermo-electrical radiation and optical pyrometers. Fuel calorimeters, Louis Thomson's Bomb and Boys', Liquefaction of gases. Critical constants. The specific heats of gases, Adiabatics and isothermal changes. Dynamical equivalent of heat. Laws of thermodynamics. Carnots cycle—absolute scale of temperature.

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Light.—Photometry. The sextant. The lens formula. Combination of thin lenses. Dispersion achromatic lenses. Eye pieces. Polarisation.

Electrostatics.—The electrostatic field. Gauss theorem Potential. Capacity of condensers. Energy of charged condensers. Electrometers.

Practical work.—The following experiments will be included in the practical work:—

1. Conductivity by Searles apparatus.
2. " by Lees Disc.
3. Specific heats of solids and liquids by methods of mixtures and by cooling.
4. Latent heat of ice.
5. Latent heat of steam.
6. Vapour pressure at various temperatures.
7. Dynamical equivalent of heat.
8. Thermo couple.
9. Temperature co-efficient of resistance.
10. Focal lengths of lenses and mirrors.
11. Refractive index by liquid lens.
12. Spectrometer.
13. Potentiometer—Comparison of E.M.F. and internal resistance of cells.
14. Potentiometer—to measure current.
15. " calibration of voltmeter.
16. Field along the axis of a coil.
17. Determination of M. & H.
18. Copper voltameter with Tangent galvanometer.
19. Specific resistance by Post office box.
20. Figure of merit of galvanometer.

3. Chemistry.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

1. *Water*.—Sources—purification—filtration—Sterilisation of water.

Temporary and permanent hardness—boiler scales—water softening—Iron in water.

Effluents.

2. *Fuels*.—Solid, liquid and gaseous fuels—Proximate and ultimate analysis—calorific value—chemistry of combustion—Analysis of flue gases and its significance.

3. *Building materials*.—Theory of drying of paint oils—Setting of Gypsum—mortar, Chemistry of cement, manufacture and its analysis. Setting of cement, porcelain and refractories. Chemistry of lime, surki and clay and reactions.

4. *Adhesives, abrasives and polishes.*

5. *Lubricants.*

6. *Rubber and insulating materials.*

7. *Metallurgy*.—Non-ferrous (common) metals and alloys. Iron and steel—corrosion and its prevention.

Practical.

1. *Qualitative*.—Simple qualitative analysis leading to identification of simple salts without interfering radicles and elimination. (Identifications involving state of oxidation or complex radicles to be excluded).

2. *Quantitative*.—Simple exercises in Volumetric analysis. (a) Acidimetry and alkalimetry (b) Permanganate titrations.

4. Applied Mechanics.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Statics.—Coplanar forces—Parallelogram, triangle and polygon of forces—graphical methods.

Statically determinate forces.—Calculation and graphical determination of forces in members of simple roof-trusses and braced girders, cranes, etc.

Principle of work.—Simple machines.

Properties of sections.—Calculation of areas, positions of centroid, neutral axis, moments of inertia, modulus of section and radii of gyration with special reference to structural shapes.

Simple stresses and strains.—Compressive, tensile, shearing, and bearing, Hooke's law, stress-strain and load-extension curves, dead, live and shock loads; factors of safety and working stresses; work and

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resilience, elastic moduli. Poisson's ratio and relation between elastic constants, temperature stresses, composite bars.

Riveted Joints.—Resistance of a rivet or bolt in single or double shear and in bearing and the working strength of a rivet or bolt, strength of lap and butt joints; efficiency of joints.

Beams.—Cantilever, simply supported and overhanging beams subject to symmetrical or unsymmetrical static loading—calculation and graphical determination of bending moments and shear forces, relation between load distribution, shearing force and bending moments. Theory of simple bending proofs of formulae and their applications. Strength of beams and beams of uniform strength.

Fixed Beams.—B. M. and S. F. diagrams under symmetrical loading. Calculation and graphical determination of slope and deflection under such loading.

Method of sections applied to trusses and frames.

18
Deflection.—Relation between curvature, slope and deflection. Proofs of standard formulae and their applications. Stiffness of beams. Evaluation of deflection from bending moment diagrams.

Columns.—Long and short columns, axial and eccentric loading, effect of end conditions, equivalent lengths and slenderness ratio, eccentricity factor, column formulae, their derivation and practical applications, laterally loaded columns and struts.

Graphic Statics.—Composition and resolution of forces. Triangle and Polygon of forces—Bow's notation—the funicular polygon—Moment of a system of forces.

Graphical determination of geometric properties of sections such as area, position of centroid and neutral axis, moment of inertia and radius of gyration section modulus figures. B. M. and S. F. diagrams for beams under static loading with or without end restraint.

Stress diagram for simple framed structures and simple roof trusses with or without wind loads, Elastic curve for beams of constant and variable moment of inertia, with or without end restraint.

5. Civil Engineering.

(Common to Civil, Mechanical, Electrical and
Tele-Communication Branches).

1. Building Materials—

(a) *Stones, Bricks and Tiles.*—Different varieties, their characteristics, tests and uses, methods of quarrying and blasting rock and

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dressing stones, choice and suitability of materials and methods of manufacture of bricks and tiles Surki. Its properties and manufacture. Sand—mechanical grading and properties.

(b) *Limes, Cements, Mortars and Concrete.*—Different varieties, their properties, tests and uses, choice and suitability of materials and methods of manufacture of limes, surki and cements. Standard mixtures for different purposes. Artificial stones, their preparation and uses.

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(c) *Timbers.*—Varieties, classification, characteristics, tests and uses of Indian timbers. Defects in timbers and causes of decay. Seasoning and preservation. Fire proofing Market forms and standard sizes for different purposes. Strength and stiffness formulae as applied to calculation of timber sizes.

Plywood and its uses.

(d) *Iron and Steel.*—Properties and Engineering uses of Iron and Steel.

(e) *Paints and varnishes.*—Different kinds of paints and varnishes—Uses in building construction, their preparation, properties. Bituminous products—Tar, asphalt and their properties.

(f) *Miscellaneous materials.*—Engineering uses of other metals and non-metals commonly employed in building construction.

(g) *Glasses.*—Special varieties.

(h) *Patent materials in the market.*—Sanitary ware—fire clay, stone ware.

2. Building Construction—

General.—Preliminary investigation as to suitability of site for different types of buildings, trial pits and borings, determination of bearing capacity of soils, etc. Rankine's formula.

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Foundations.—Drainage of building site; Excavation and trenching, methods of timbering excavations, shoring and under-pinning, methods of improving bearing capacity, ordinary foundations such as masonry footings, grillage and pile foundations and simple calculations pertaining thereto.

Plain Masonry and Brick work—Different kinds of bonds and methods of laying, coursed and uncoursed rubble ashlar, coping, cornice and string courses, finishing and pointing, damp-proof construction, anchorages in walls, fire resisting construction for flues, chimneys and

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fire place, dressings such as door-jambs and door and window sills, flat, segmental, pointed and relieving arches, inverts, centering for arches and striking of centres, vaults and domes.

Floors and Roofs.—Floors of different materials, terraced and pitched roofs, jack-arched floors and roofs, steel beam and girder floors—simple design calculations, timber, mild steel and composite roof trusses—simple design calculations, different types of roof coverings and ceiling and constructional details. G. I. sheets as a roofing material,

Carpentry and Joinery.—Different kinds of joints in timber doors, windows and ventilators, partitional scaffolding and false-work, simple roofs and bridge frames.

Stairs.—Different types of stairs—straight and spiral in timber plain masonry, iron and concrete, simple design calculations.

Columns.—Details and methods of construction in brick stone, iron and concrete. British standard sections—British standard specification for structural steel.

Scaffolding.—Materials used and principles of erection and maintenance.

Hoisting appliances—construction and maintenance.

Safety measures—organisation and supervision—safety regulations.

6. Mechanical Engineering.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Fuels.—Solid, Liquid, and Gaseous.

Boilers.—Vertical, Lancashire, Cornish, Water tube, marine and locomotive—boiler efficiency—super-heaters—feed water heaters—accessories and management.

Steam Engines.—Single cylinder non-condensing steam engine with D slide valve. Sketch and names of principal parts. Explanation of admission, cut off, release and compression; valve mechanism. Principles underlying expansion in stages. Arrangement of cylinders for compound, triple and quadruple expansion engines. General ideas regarding Meyers. Trip and Corliss valve gear.

Internal Combustion Engines.—4 stroke and 2 stroke cycle. Parts. Classification—high speed, medium speed and slow speed. Low

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compression, medium compression, high compression and Diesel engines. Fuels for internal combustion engines. Carburettors, fuel pumps, Magnetos, coil ignition, vaporisers and hot bulbs. Lubrication and cooling of the cylinder.

Gas Producer Gas Engine.

Testing of Engines.—Indicator diagrams. Indicated H. P. Brake Horse Power. Fuel consumption, Mechanical and Thermal efficiencies.

Transmission of Power.—Gear drive, belt drive, rope drive and chain drive, velocity ratio. Simple problems.

Workshop Practice.—General ideas of forging, casting, machining and fitting. Elementary ideas of a lathe, shaping, planing, drilling and milling machines and the kind of work turned out by each machine.

Materials used in Construction.—Cast iron, wrought iron, mild steel, carbon steel and alloy steels. Copper and its alloys, Aluminium. Galvanising and welding.

7. Electrical Engineering.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

1. *Electrical Circuit.*—Practical system of electrical units, Conductors and insulators, specific resistance, temperature co-efficient. Series and parallel grouping of resistances. Kirchoff's circuit laws and application.

2. *Electro-magnetism.*—Magnetising force. Magnetic induction. Permeability. B.H. curve and its determination. Hysteresis and determination of hysteresis loss. Calculations of simple magnetic circuits.

3. *D. C. Machines.*—Component parts of a Dynamo and their functions. Magnetisation curve, Self excitation and voltage drop on load of shunt generator. Elementary theory of compound generator. D.C. motor. Elementary theory of operation and characteristics of shunt and series motors. Change in speed and direction of rotation. Starter and field regulation.

4. *Alternating currents.*—Production of alternating voltage. Wave form, frequency and amplitude. R.M.S. value, average value. Form factor. Phase difference. Vector addition of sinusoidal currents and voltages. Inductance, reactance and impedance. Power and Power factor. Solution of simple series and parallel circuits. Elementary ideas of polyphase circuits.

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5. *A. C. Machines*.—Elementary ideas on the working of the alternator, synchronous motor, induction motor and starter, Rectifiers and their practical applications.

6. *Measuring Instruments*.—Working principles and the uses of moving iron and moving coil ammeters and volt-meters, D.C. energy meters in common use and Megger.

7. *Storage Batteries*.—Construction, physical and chemical changes during charge and discharge, capacity, efficiency and comparison of lead and nickel iron batteries.

8. *Distribution*.—Two wire D.C. system. Calculation of voltage drop and efficiency. Elementary ideas of 3 phase, 4 wire system. House wiring and accessories. Testing of faults in house wiring.

8. Surveying.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Chain Survey.—Equipment—pacing—ranging and chaining lines—errors in chaining—corrections.

Methods of avoiding obstacles—problems in ascertaining distances. Setting out a right angle.

Offsets. Use of cross-staff—Tie-lines.

Optical squares—cross staves.

Scales and R F.

Plotting—computing areas—Simpson's rule.

Compass Survey.—Prismatic compass—description, use and adjustments. Bearings—local attraction, inclusive angle method. Magnetic and true meridians—variation—declination. Plotting graphical adjustment of error of closure.

Plane Table Survey.—Equipment—setting and use of plane table.

Alidades—simple and prismatic.

Resection—3 and 2 point problems.

Levelling.—Level types—cushings. Cooke's Reversible, Dumpy setting up, use, adjustments, Staves.

Spot levels—Fly levels—Bench marks—profile levelling—cross sections—degree of accuracy.

Curvature—refraction. Reciprocal levelling.

9. Geometrical Drawing.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Practical Plane Geometry.—Construction and use of scales, Areas of plane figures. Methods of drawing ellipse, parabola, hyperbola, cycloidal and involute curves and the helix.

Practical Solid Geometry.—Projections of points, lines and planes; projections of simple solids, prisms, pyramids, cylinders and cone. Development of plane and curved surfaces, interpenetration of solids, cylinders, and cones, prisms and pyramids, Isometric projection and elements of perspective.

10. Machine Drawing and Design I.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

The use of drawing instruments.—Printing, conventional signs, Inking and colouring, bolts, nuts and rivets, proportions, riveted joints, Pipe joints. B. S. specifications ball, socket and flange. Shaftings and couplings, flange, muff, claw and flexible, Keys and keyways, Jib, bearings and journals, Brackets—ceiling and wall. Pulleys, C. Iron and W. I.

Steam and Internal combustion Engines.—Cylinder, piston and slide valve. Eccentric sheave, strap and valve rod. Crosshead, guides and gudgeon pin. 4—stroke and 2—stroke engine cylinder and piston. Valves and valve mechanism. Timing gear, cam shaft, tappets and rockers. Connecting rod and crankshaft, fuel pumps and atomizers.

Second B.E. Examination.

(CIVIL BRANCH.)

11. Mathematics II.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

1. *Differential Equations*.—Ordinary differential equations involving two variables. Equations of the first order and of the first degree. Standard forms. The general linear equation with constant coefficients. The method of solution by operators. Equations reducible to the linear form with constant coefficients. Simultaneous linear equations of the first and second order with constant co-efficients.

2. *Advanced Mathematics*.—Probability and errors of observation (including the Binomial Law, the probability curve, probable error, standard deviation and the method of least squares).

(ii) Fourier series and harmonic analysis.

12. Mathematics III.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

1. *Vector analysis*. (including addition and subtraction of Vectors, Scalar and vector products of two vectors, the scalar and vector triple products, differentiation and integration of vectors, definite integral of a vector function).

2. *Dynamics of a Particle*.—Rectilinear motion. Equations of motion. S. H. M. motion in a resisting medium.

Motion in two dimensions—

(a) *Cartesian Co-ordinates*.—Composition of S.H.M's. Motion of a particle in a vacuum and in a resisting medium. Equation of energy.

(b) *Polar Co-ordinates*.—Velocity and acceleration in Polar co-ordinates. Central forces. Differential equation of orbit law of inverse square.

Constrained motion.—Tangential and normal accelerations. Motion on a smooth or rough curve in a vertical plane.

13. Strength of Materials and Theory of Structures I.

1. *Compound stresses and strains*.—Stresses under combined strains, principal stresses and principal planes, ellipse of stress, application to different cases.

Distribution of shear stress in a beam section.

2. *Behaviour of Materials under test*.—Methods of testing and appliances used in determining the elastic constants and testing materials to destruction under tension, compression, shear, torsion and bending impact and hardness tests, tests under repeated and alternating stresses, fatigue of materials, factors of safety and working stresses, latest advancements in the science of testing materials,

Simple laboratory tests for identification of soils, mechanical analysis, determination of water content, specific gravity, density, permeability, etc.

3. *Circular shaft*.—Theory of pure torsion, shear stress, angle of twist, strength and resilience, horse-power transmission, combined torsion and bending with or without thrust, determination of principal stresses and maximum shear stresses, equivalent bending moments and equivalent twisting moments.

4. *Close coiled Helical springs*.—Extension under axial pull and maximum shear stress, angle of twist and torsion and maximum direct stress, strength and resilience.

5. *Thick shells and cylinders*.—Stresses and strains under internal and external fluid pressures only without initial stresses.

6. Maxwell's Theorem, Deflection of frames, Castigliano's theorem I. Resilience due to bending moment, shear and torsion

7. *Continuous beams and propped cantilevers*.—Theorem of three moments, calculation of reactions, bending moments, shear forces, deflection and slope—Moment distribution methods.

8. *Masonry works*.—General conditions in stability.

Stability. Middle third rule—lines of resistance. Distribution of pressure intensities—Masonry Chimneys with effect of wind pressure.

9. *Theories of earth pressures*.—Retaining walls—Rankine's theory applied to foundations—Wedge theory—Rebhann's, Winkler's, and Bligh's graphical constructions with corrections.

10. *Graphic Statics*.—Determination and dead load stresses in Warren, N. Girder, Pratt (both deck and through types) Hogback, Whipple Murphy and Petit trusses.

Deflection of trusses and frames with Mohr's correction stresses in transmission towers, trestles, Fink and Island roof trusses including effect of wind loads.

Graphical determination of earth pressures and lines of resistance for retaining walls—Stability of masonry chimneys due to wind pressure.

14. Hydraulics.

(Common to Civil, Mechanical and Electrical Branches).

Fluids at rest.—Properties, Intensity of pressure, transmissibility and measurement of pressure, total pressure, centre of pressure.

Floating bodies, equilibrium, stability, metacentre.

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Fluids in motion.—Ideal fluid—steady and unsteady motion—stream line—Bernoulli's theorem. Applications—Venturimeter—Vortex motion.

Orifices and notches.—Standard conditions—co-efficients of contraction, Velocity, discharge and their determination for small orifices. Form of jet—Suppressed contraction—Large orifices—Drowned and partially drowned orifices—velocity of approach—sudden expansion and contraction—mouth pieces—time of discharge. Weir, standard conditions—rectangular—End conditions—Triangular, trapezoidal, drowned weirs—Height of weir—Nappe and its stability—Flatcrested weirs—Guaging weirs—weirs and anicuts—Bridge openings—Sluices.

Pipes.—Fluid friction. Viscosity—Turbulent motion—Critical velocity—loss of head and hydraulic gradient—Straight circular pipes of uniform diameter and hydraulic mean depth—Empirical formulae, Chezy, D'Arcy, Kutter and Logarithmic Bends—Elbows—Valves—Variation of velocity in cross section—practical problems—Diameter of pipes—Branch pipes—Hydraulic transmission of power—Variable diameter—Syphons—Hammer action.

Open Channels.—Discharge Formulae, best form of channels, variation of velocity, guaging of discharge, methods, and instruments used.

Water Power Engineering.—Hydrology—use of hydrographs, duration curves and mass curves in analysis of power available from hydro-electric plants. Methods of estimating the probable output, primary and non-primary of a project. Hydro-electric development.

15. Structural Engineering.

Foundations.—Difficult foundations such as coffer dams, well foundations, cylinder foundations, cribwork and caissons and concrete monoliths—details of construction and methods of working.

Elementary principles of soil mechanics.—Soil characteristics, analysis and their relation and elementary applications to foundations and retaining walls.

Masonry.—Retaining walls. Practical profiles, data, formulae and empirical rules for design, methods of relieving side pressure and improving stability, provision for drainage expansion joints, other important details of construction, detailed design of gravity and panelled retaining walls.

Bridges and Culverts.—Data for design, practical rules for design, waterway for bridges and economical spacing of piers, usual dimensions for highway and railway bridges, provision for drainage, design of piers and abutments, detailed design of arched bridges and culverts for specifications and empirical rules.

Reinforced concrete.—General principles. Theory and design of rectangular beams, tee-beams, slabs and columns and foundations, arrangements of laying reinforcement, leading systems of reinforcement, economical methods of construction, design and details of formwork.

Structural steel work.—Beams and girders. Properties of British Standard sections, detailed design of beams, compound girders. built-up plate girders, limiting spans and economical depths, design of flanges and webs, curtailment of flange plates, design of joints and connections, types of stiffeners and rules for their spacing, methods of fabrication, detailed design of crane and gantry girders of built up plate girder and typical details of construction.

Columns and struts.—Plain and built up sections, assumptions regarding end conditions, practical formulae for design, detailed design of stanchions for building and of compression members of roof trusses and design and details of caps, bases, brackets for stanchions, joints and splices on stanchions, size, pitch and arrangements of rivets on flanges on plated stanchions, lacing on stanchions.

Roof trusses.—Types of roof trusses, limiting spans, rise and camber economical spacing, data for design, detailed design of members including purlins, joints and connections, wind bracing on roof trusses, steel frames sheds.

16. Railway and Highway Engineering.

(a) *Railway Engineering.*—Permanent way—ballast, sleepers, rails, chairs and fastenings.

Points and Crossings.—Details of construction, different types, turnouts, cross-overs, slips, formulae and practical rules for setting out.

Plate laying and Maintenance, of track, Super-elevation, creep of rails.

Station works and Machinery.—Station buildings, Platform, sidings, staff quarters, engine sheds, turn-tables, triangles, water columns, ashpits.

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Mechanics of Railway traction:

Standard year Design.—Single and double lines, stations, passenger and goods yards, station yards, and junctions.

Selection of alignment and surveys.—Classification of railways. Preliminary investigations, reconnaissance, preliminary and location surveys, curves and the gauge problem.

Tunnels.—Construction of tunnels in different soils, drainage and ventilation—Subaqueous tunnels, shield tunnelling, tunnelling between coffer dams, tunnelling with compressed air.

Standard dimensions on Indian railways, rules for preparation of railway projects.

(b) Highway Engineering.

Importance of roads, classification of roads, preliminary investigations, reconnaissance surveys, consideration affecting alignment, obligatory points, grades, ruling gradients, curves and widths, availability of materials of construction, different types of roads and pavements, methods of construction, materials of construction, their tests, soil stabilisation, base course and wearing course, treatment of road surfaces, sub-drainage, and surface drainage pipes, drains, gutters and culverts, section of roads camber and crown fromulae, hillroads and causeways, construction and maintenance of embankments and cuttings, repair of roads, road signs, side walls, curbs, railings, etc. Arboriculture, rules for preparation of road projects. Standard specifications for different types of roads, Machinery employed for construction, maintenance and cleaning.

Note:—(1) Earth work calculations are dealt with under Surveying.

(2) Highway masonry Bridges are dealt with under Structural Engineering 1.

17. Surveying.*Levelling:*

Contouring—clinometers—earthwork and capacity of reservoir—areas—volumes.

Field books—types—arithmetical checks—Rise and fall and collimation methods.

Plotting of longitudinal and cross sections scales—distorted and natural. Allowable errors.

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Setting out of works.—Curves, without angle measuring instruments. Building—Erection of profiles for banks.

Instruments.—Use, construction and adjustments of.

Levels. Engineers improved level (Government of India pattern) Zeiss and gradientor.

Theodolite—transit, micrometer, double reading.

Traverse Surveying.—Stations, Angle by repetition, Gale's method of plotting by co-ordinates, distribution of errors.

Setting out of works.—Curves by theodolite, simple, compound and transition—Curve tables setting out and measuring engineering works.

Note:—There will be a theory and practical examination covering the syllabus for the Civil Branch. The Mechanical and Electrical Branches will have examination in Practical work only.

18. Engineering Geology.

Mineralogy.—Principal physical properties of minerals. The chief characteristics of the rock forming minerals, quartz, feldspar, mica, pyroxenes, amphiboles, olivine, garnet and epidote.

Petrography.—Division into igneous, sedimentary, classification of igneous rocks. Granite, syenite, Diorite, gabbro, norite, peridotite, pitch stone, porphyry, dolerite, obsidian, pumice, trachyte, andesite, basalt.

Sedimentary rocks and the more important metamorphics, their distinguishing characteristics.

Structural Geology.—Stratification, dip, strike, outcrop, outlier, inlier, folds, faults, cleavage, joints, unconformity and overlap Batholiths, laccoliths, sills, dykes and eruptive veins.

Civil Engineering Geology.—The physical properties, selection and distribution of building stones and materials, road foundations. Properties and selection of road metals.

Principles governing the economic quarrying of stone and selection of quarry sites.

Stability of slopes and land slides affecting cuttings, embankments, reservoir sites. etc. The texture, porosity and structure of rocks affecting tunnelling, sinking shaft.

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Water supply—Rainfall considerations. Underground water circulation—Artesian wells.

Indian Geology.—Geology of India in broad outline. Distribution of the stratified and igneous rocks in India. Occurrence of the important rock forms, ores and minerals of India.

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| (1. Iron | (2. Copper. |
| (3. Manganese. | (4. Chromite. |
| (5. Coal. | (6. Mica. |
| (7. Asbestos. | |

Practical.—The practical will include identification of the more important rocks and minerals with the aid of simple physical tests, determination of dips and strikes with clinometer compass. Map drawing (simple outcrops) structural drawing.

19. Quantity Surveying and Cost Analysis I.

Approximate Estimates of buildings.—Working out approximate cost (i) on plinth area basis and (ii) on cube rate basis, with reference to cost of recently constructed structures in the neighbourhood.

Detailed Estimates:

Schedule of Quantities.—Standard methods of measurements and units of various items of work taking out quantities for buildings (sheds, residences, schools, offices, etc.) of one or more floors, road work, culvert, causeways and small bridges abstract estimate.

Cost analysis.—Standard schedule of rates and data, Leads and conveyance of materials, preparation of detailed data of rates, lump sum provision. Survey of a complete building including steel work, plumbing, and electrical fittings.

Specification, tenders and contracts.

General principles of valuation and rental cost of land and building.

20. Building Drawing.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

(a) Detailed drawing of building details as dealt with under Building construction course (*vide* syllabus—Civil Engineering).

(b) Working drawings of small buildings from sketches and specifications together with simple design calculations for teak wood scantlings, lintels, R. S. beams, etc.

Final B. E. Examination.

(CIVIL BRANCH)

21. Advanced Theory of Structures.

1. Dams—Classification—relative merits—forms and proportions of profile—Assumption as to stress distribution in masonry—Analysis of given profile distribution of shear stress—stress on vertical sections of masonry dams.

2. *Moving loads and influence lines.*—Curve of maximum bending moments and maximum shear forces; the enveloping parabola and determination of equivalent uniformly distributed load; influence lines for reaction; shear force, bending moment and deflection; influence lines for forces in members of braced girders and spandil; braced arches; reversal of stress under live load.

3. *Suspension Bridges and Arches.*—Stresses in loaded cables and hanging chains; stiffening girders, moments and shears in such girders, elastic theory of the rigid arch; Eddy's theorem, stresses due to rib-shortening and temperature changes; reactions and horizontal thrust in rigid, two-hinged and three-hinged arches; reaction loci; lines of resistance through rigid and hinged arches under dead and live-loading.

4. *Structural Frames.*—Calculation and graphical determination of forces in members of roof trusses with knee-braces, in braced girders of variable depth with or without secondary members and in trestles, displacement diagrams for braced girders; analyses of simple types of indeterminate frames. Portal and sway frames.

5. Elementary application of column analogy.

6. *Graphic Statics.*—Stress diagrams for trusses with knee braces, portal and sway bracings. Curves of maximum bending Moment, and shear force and enveloping parabola—Lines of resistance in dams, shear stress distribution—stress on vertical planes.

Influence lines for beams, girders, and arches. Lines of resistance in arches. Fuller's and Eddy's constructions. Graphical analysis for stresses in domes—Elementary applications of column analogy.

22. Structural Engineering II.

Detailed design of gravity, and arch dams—design of masonry chimneys.

Reinforced Concrete.—Bridges—simple types—beam and slab, solid arch, open span drill, Bow string girder—and single span portal frames. Box culverts.

Water tanks, circular, square with or without trestles and intze types—Domes.

Cantilever and counterfort types of retaining walls. R. C. Piles and symmetrically loaded rafts.

Structural Steel Work.—Data for design—detailed design of highways and railway bridges of plate and lattice girder types, economical proportions, standard dimensions, minimum clearances and head room; different types of floors, transverse and lateral bracing, provision for drainage, other important details of construction. General principles relating to the design of suspension bridges, steel water tanks and towers, structural parts of cranes, chimneys and domes.

Timber.—General Principles of design in timber with special reference to structures such as—roof trusses, beams, columns, bridges, trestles and form work for R. C. structures.

Erection—General methods of erection of building and bridges.

23. Hydraulics and Hydraulic Machinery.

Open Channels.—Non-uniform flow, Hydraulic Jump, Venturi-flume.

Impact of water of jets.—Pressure of jet on stationary and moving, flat or curved vanes. Work and efficiency.

Turbines.—Classification, reaction, impulse, inward, outward and mixed flow, Belton wheel; specific speed; characteristic curves; Principle of similarity and its application to model testing—Propeller turbines.

Pumps.—Reciprocating pumps—Types, work done, effect of acceleration and frictional, resistance, separation air vessels.

Centrifugal pumps.—Vortex chamber—Pressure in the pump, specific speed. Principle of similarity, characteristic curves—Application of—Principle of similarity to model testing multistage pumps.

Theory of models applied to condition of dynamic similarity, study of models such as dams, weirs and embankments.

24. Design and Drawing I (Structural).

Candidates will be required to answer one question set from the following list which will include design as well as detailing. The question set will relate to any one item or part thereof.

Reinforced Concrete.—Beams, slabs, columns, pile and symmetrically loaded raft foundations—R. C. framed buildings—Retaining walls—Cantilever or counterfort type water tanks—Circular, square with or without trestles—intze types—Domes.

Bridges.—Beam and slab, solid arch, open spandril, Bow string girder types and R. C. rigid frames of a single span only.

Steel.—Beams, plated beams, column bases grillage foundations—Roof Trusses and gantry girders.

Plate and Lattice girder bridges—Design of component parts.

Water tanks—Square, rectangular and cylindrical types.

Steel chimneys—suspension bridges.

Timber.—Beams. Columns—trusses and simple bridges.

Masonry.—Buildings—Bridges, culverts and causeways in plain masonry.

25. Irrigation Engineering.

General.—Importance of irrigation works, productive and protection of works, projects, General principles of flow, lift, perennial, basin or inundation and well irrigation; principal crops; duty factor affecting duty for crops under storage and direct flow irrigation duty in Madras systems. Rainfall and Runoff—study of rainfall statistics; utility in run-off calculations; maximum flood discharge. Percolation, evaporation and absorption losses in canal and storage system, uplift and piping stability of works affected by percolation, Silt-analysis; silting of reservoirs; flow in canals. Kennedy's critical velocity and its applications.

Diversion works.—General description of rivers, river weirs, selection of sites; types for permeable and impermeable foundations. Formulae for design of weirs crest shutters; principles governing the design and construction of river regulators, head regulators, under-sluices, flood banks, and protective works, examples.

Storage works.—Selection of site, masonry dams, principles of; design of gravity and arch and other types, uplift in masonry dams, drainage galleries; expansion of joints; methods of construction;

Earthern dams; causes of failure; types of dams; materials for dams, methods of construction, drainage of earth dams and foundations; elementary principles of soil mechanics in relation to earth dams. Component works—sluices, surplus escapes, ordinary types, stepped waste weirs, Ogee type spillway; syphon spillway; selection of sites. Tanks—isolated and rainfed—single or in groups, supply, capacity, repairs to bunds and breaches. Flood absorptive capacity of reservoirs.

Distribution System.—Design and alignment of canals, distributaries, etc., in deltaic and non-deltaic areas; capacity, command, limiting, velocity; lining of canals. Drainage water logging, alkalinity of soils, principles in design of drainage channels, outfalls, general description, construction and design of masonry works on canals—(a) for regulation of water-levels, rapids, falls, or drips, notches, escapes, syphon-well drops, sluices—(b) cross drainage works and surplus works aqueducts, syphon aqueducts, superpassages, level crossings, inlets, and outlets. (c) Communication works—road, dams, fords, etc.

Navigation Canals.—Main features, locks. Canals for combined navigation and irrigation.

River Training works. Spurs, groynes, Bells, bunds, Mattresses, aprong, etc. Soil erosion—its causes, prevention and control.

Harbours.—General principles governing the design of harbours. Effects of natural forces; tides, currents, fetch, exposure and wave power. Considerations affecting the general design of natural and artificial harbours. Design and construction of break waters. Signals, buoys, light houses and illumination. Dry and wet docks. Slips. Drainage of harbours.

26. Sanitary Engineering.

Water supply:

Bacteriology.—Application to analysis of water and sewage.

Sanitary Engineering: Scope and objects.

Water supply.—Importance, ancient and modern water works, quantity required.

Sources.—Rain, wells, springs, rivers, lakes.

Wells.—Geology, shallow, deep and artesian wells construction, yield, quality.

Rivers.—Infiltration gallery and wells.

Storage reservoirs.—Site, capacity, compensation water dams, form, design, construction, waste weirs, outlet conditions and valve tower.

Conveyance.—Pipe line, Hydraulic gradient, types of aqueducts, syphons, air valves, scour valves and Balancing reservoirs.

Service Reservoirs.—Open and closed reservoirs, capacity and construction, water towers, elevated tanks stand pipes.

Pumps and Pumping—Pumps and suitability, pumping station.

Purification.—Sedimentation, coagulants, effects of storage on purification, infiltration galleries.

Slow filtration.—Filter beds, area, size, arrangements of sand layers, materials and construction, rate of flow, regulation. cleaning, remarks.

Rapid Filtration.—Types of filters, rate of filtration, operation of mechanical filters.

Sterilisation.—By chlorine and other agents.

Softening.—Hardness in water, methods of softening.

Distribution.—Combined and dual systems, intermittent and constant supply, mains and branches, methods of arranging distribution pipes, watering posts, fire hydrants, taps, house fittings.

Waste water detection and prevention.—Meters.

Sewerage and Sewage Disposal:

Refuse collection and disposal.—Sanitary arrangements in houses, house refuse, sullage, nightsoil, conservancy systems. Collection and removal. Disposal on land. Incinerators, destructors.

Drainage and Sewerage.—Rainfall, house drains, surface drains, underground sewers, combined, separate and partially separate systems of sewerage. Measurement of sewage flows, branch and main sewers, design and construction of manholes and sewers, ventilation and cleansing, self-cleansing velocity. Excessive and inadequate falls, automatic flushing, lifting of sewage, pumps, ejectors, lifts, intercepting and outfall sewers and their ventilation, storm overflows, outfall into sea.

Sewage Disposal.—Character and composition of sewage, disposal on land, broad irrigation, intermittent irrigation; septic tanks and dispersion trenches, sludge and sludge disposal.

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Bacterial Purification.—Contact beds, intermittent sand filtration, precipitation, trickling filters. Trade effluents and their treatment.

Public Utilities.—(Water Works, Sewerage and Sewage disposal). Hospitals, libraries, fire stations, schools, markets, burial and burning grounds, slaughter houses, public baths, parks and play-grounds, theatres and cinema halls, etc.

27. Surveying.

Sextants—Nautical and Box—Photo theodolite Solar attachments—Burt and Saegmuller—Telescopic alidade and plane table equipment—Mining dial—Direct reading tachometer—Curve ranger—Equatorial mounting.

Triangulation.—Minor triangulation—choice of stations, triangles, quadrilaterals—interlaced polygons—Signals Erection—Heliotrope.

Field observations—angles by reiteration—Vertical angle for heights.

Satellite Stations—Three point problem—Intersected points.

Base line—instruments and accessories—invar type correction—reductions of measurements.

Adjustments of angles by the method of equal shifts—least squares.

Calculation of co-ordinates—plotting.

Precise levelling—maps and map making—problems in height and distances.

Tacheometric Surveying and Subtense Measurements.—

Principle of Stadia—Formulae.

Field observations.

Staves—Subtense bar.

Field book—reduction by diagram, tables, slide rule.

Plotting by tacheometric protractor.

Hydrographic Surveying.—Tides and Tide Prediction.

Astronomical Surveying.—

Spherical trigonometry—formulae.

Convergence of meridians.

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Definitions—approximate motions of sun and stars.

Nautical Almanac—use.

Methods and calculations for determination of true meridian, latitude, longitude and time.

Hydrographic Surveying.—

Soundings—Charting.

Cross-sections of streams and rivers—discharge of rivers.

28. Quantity Surveying and Cost Analysis II.

Preparation of detailed estimate for Irrigation works such as Head wall, pipe sluices, masonry sluices, tank sluices, notches, weirs, drops, outlets, aqueducts, syphons, Superpassage, Syphon aqueducts, etc.

Estimates for scheme and project works in general.

29. Design and Drawing II (Irrigation and Sanitary).

(a) Designing and detailing important types of irrigation works, such as, tank surplus weirs regulators, drops, syphon aqueducts, superpassages, escapes, locks, etc.

(b) Designing and detailing types of works relating to water supply and Sanitary Engineering.

30. Engineering Economics.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Wealth. Supply and demand. Production, Raw materials and resources of industry. Capital. Industrial evolution. Industrial organisation. Ownership. Partnerships. Limited companies. Cartels and Trusts. Managing Agencies. Provision of Capital Shares and debentures.

Value and exchanges. Money and credit markets. Banking. Domestic and international trade. Foreign exchange. Taxation and Insurance.

Book-keeping and accounts: The journal, cash book, purchase book, sales book, ledger. Double entry Balancing: Trial balance, balance sheet. Trading and profit and loss accounts. Bad debts. Auditing.

Principles of industrial accounting. Financial statements. Valuation and depreciation. Costing and estimating. Prime costs, oncosts, selling cost. Control of expenditure: budgets: Reports, Office organisation.

31. Report Writing.

(Common to Civil, Electrical, Mechanical and Tele-Communication Branches).

Engineering

English.—Principles of composition and the rules and conventions of good use as applied to the word, the sentence and the paragraph. Development of vocabulary. English idiom. Letter, Precis, and Essay writing. Pronunciation. Talks and debates. The correction of common mistakes in writing and speaking. The avoidance of "office jargon".

REPORT WRITING.

Classification of Reports:

Typewritten Internal Reports.
Reproduced Internal Reports.
Technical Monographs.
Technical Reports.

Administrative Control of Reports:

Engineering Reports.
Assignment of Reports.
Preparation of Drawings.
Reproduction of Reports.

Content of Reports:

Titles and Title page.
Letter of Transmittal.
Table of contents.
Summary.
Detailed Report.
Appendices.

Styles and Standards:

Abbreviations.
Spelling.
Capitals.
Punctuation.

Forms of Expression.
Verb Tenses.
Accuracy of Numerals.
Tabulations.
Paper.
Carbon paper.
Marging.
Headings.
Spacing and Indenting.
Page Numbering.
Uses of outline form.
Index tabs.
Binders.

Illustrations:

Numbering of Illustrations.
Choice of Illustrations.
Types of Illustrations.
Preparation of Illustrations.
Photographs.
Reports with limited copies complete with illustrations.

Use of Colours and Symbols:

Progress maps.
Topographic Maps.
Large-Scale Topographic Sheets.
Other maps and charts.

Methods of Reproduction:

Methods of Reproducing Text—Matter.
Methods of Reproducing Drawings.
Reproduction cost.

Variation in standards for reports reproduced in Quantity.

Acknowledgements.

Bibliography

(Books recommended for reference:—"The Preparation of Engineering Reports for the Tennessee Valley Authority"
—Technical Monograph, No. 21. Knoxville, Tennessee
September 1942—District Officer's Manual. Para 62—I
—XI—Style in notes and drafts, (Government Publication),

MECHANICAL BRANCH

11. Mathematics II.

(Common to Civil, Mechanical, Electrical and
Tele Communication Branches).

Vide Syllabus—Second B.E. Examination—Civil Branch.

12. Mathematics III.

(Common to Civil, Mechanical, Electrical and
Tele-Communication Branches).

Vide Syllabus—Second B.E. Examination—Civil Branch.

32. Applied Mechanics and Elements of Structural Engineering.

(Common to Mechanical and Electrical Branches)

- (A) Deflection of framed structures—Maxwell's and Castigliano's Theorems—Rankine's theory of Earth Pressure and applications to foundations—Rebhans construction.

Stress Analysis and design of Transmission Towers and Poles.

Stability of masonry structures such as Walls, low dams.

Theorem of three moments.

- (B) Graphic Statics—Graphical solutions for pressures on retaining walls and masonry structures—Stresses in Transmission towers and trestles—Truss deflection by Graphical Methods.

- (C) Elementary structural engineering—Reinforced concrete—Properties of concrete and Reinforcements—Testing—General principles of design of Lintels, Beams, slabs, column and column footings—Shear, bond and diagonal tension, its nature, evolution—Location of reinforcement.

Structural Steel—Design of beams, columns and column bases and roof trusses.

- (D) Principle of stress and planes—Simple applications, strength and stiffness of shafts of circular and square cross-sections under pure torsion, with or without Bending Moment and Thrust.

Oscillations of elastic systems—elementary torsional oscillation shafts—Whirling of shafts—Shrink fits—Rotating discs—Balancing Beams not originally straight. Crane hooks—Thick cylinders and shells.

- (E) Tests on mild steel, cast iron, Brass, Copper, Gun metal, wood, etc., for tension, compression and torsion—Determination of elastic constants—use of strain measuring devices—Tests on fatigue of metals—Bending, Hardness and Impact tests—Tests on wire ropes, springs, Chains and insulators. Tests on columns.

14. Hydraulics.

(Common to Civil, Mechanical and Electrical Branches).

Vide Syllabus—Second B. E. Examination—Civil Branch.

33. Heat Engines I.

Thermodynamics.—Units of heat. Heating and expansion of gases. Internal energy of a gas. Laws of perfect gases. Air cycles. Carnot's, Otto, Diesel and dual combustion cycles. Entropy of gases.

Internal combustion Engines.—Gas and petrol Engines, Diesel and semi-Diesel Engines. Working and features of two and four stroke cycles. Efficiencies and Engine Tests. Motor car engine and accessory parts, carburettors and Electrical Ignition systems.

Air Compressors and Motors.—Transmission of power by compressed air. Single and multistage compressors—Inter cooling—Calculation of power, dimensions of cylinders and efficiency. Conditions for maximum efficiency. Effect of clearance similarly for air motors. Pre-heating; overall efficiency. Mechanical details, Fans and blowers.

Refrigeration.—General Principles. Types of mechanical refrigerators. Air compression refrigerators, vapour compression refrigerators. Choice of vapours for commercial refrigerators. Comparison of working fluids, calculation of power required and co-efficients of performance. Rating, testing, Mechanical details. The use of entropy diagrams for refrigeration problems. Absorption machines. Applications of refrigeration—Principles and methods of air conditioning. Air conditioning plant. General lay-out and working of the plant.

Engine Details.—Cylinders, piston, connecting rod, crankshaft, bearing, bed plates, timing gear, cam shafts, valves, fuel injection, electrical ignition and governors, lubrication and cooling of cylinders, starting arrangements.

Material used for manufacture of various parts of Engines.

34. Automobile Engineering.

SPECIFICATIONS.

- Engine Types.*—T Head, L Head, Overhead and Sleeve Valves.
- Cylinders.*—Separate, and unit construction.
- Arrangement.*—Straight Vee and opposed. Cylinder heads and liners, wet and dry liner assembly.
- Pistons.*—Cast iron, Aluminium alloy, composite and bimetal.
- Connecting rods.*—Steel and alloy.
- Crankshaft.*—Construction, balancing and vibration dampers.
- Clutch.*—Hele-Shaw, multiplate dry and single plate dry.
- Flywheel.*—Ordinary and fluid.
- Carburettor.*—Ordinary and down draught.
- Ignition.*—Magneto and coil.
- Petrol Feed.*—Gravity, vacuum, diaphragm and Electric pump.
- Gear box.*—Clash type, constant mesh, synchro mesh and free-selective. Hydraulic and other gearless transmission.
- Transmission.*—Cardan shaft, Universal joints, crown and bevel, worm gearing and chair.
- Differential and Back axle.*—Fully floating three quarter and semi floating.
- Chassis and its components.*—Front axle and springs, wheels and tyres.
- Starting and Lighting systems.*—American, British and Continental.
- Lubrication and Cooling of Cylinders.*—Low pressure and high pressure systems. Radiator construction, air cooling, water cooling, steam cooling and oil cooling. Thermostat control of radiator temperature.
- General.*—Wheel alignment. Service: upkeep, maintenance and repairs.
- High speed Diesel Engines used for automobile work.

35. Electrical Technology I.

(Common to Mechanical and Tele-Communication Branches).

General Principles.—Electric and Magnetic Laws, Units and Standards. Electric and magnetic properties of materials. Electric

and Magnetic circuits. Magnetic measurement of permeability and hysteresis.

Measurements.—The Principles and construction, use and calibration of instruments ordinarily employed, moving coil, soft iron, dynamometer, thermal and electrostatic types. Direct current energy meters. Megger.

Generators and Motors.—Continuous current generators and motors; shunt, series and compound type construction, working and simple theory. Types of windings; lap and wave. E.M.F. equation. Starter and field regulators. Speed.

Speed control of D.C. Motors. Armature reaction. Tests by direct and indirect methods. Parallel operation, and sharing of load between generators. The third brush and Rosenberg generators.

Batteries.—Secondary cells. Elementary theory and testing. Practical applications of storage batteries.

Illumination.—Units and standards. Polar Curves. Use of shades. Photometry.

Alternating Currents.—Elementary theory of single and poly-phase current.

Transformers.—Single and polyphase transformers and their construction. Tests of efficiency and regulation by direct and indirect methods on single phase transformers. Polyphase transformer.

36. Machine Design and Drawing II.

The student will prepare assembly and detailed drawing of following from their own sketches. They will submit the sketches in standard sketch book along with their drawing.

- (1) Steam engine cylinder piston and valves.
- (2) Internal combustion engine cylinder, piston, valves and valve mechanism.
- (3) A 4-speed gear box for an automobile engine.
- (4) Single plate dry clutch for an automobile.
- (5) Lathe, fast and loose head stock.
- (6) A scroll chuck for a lathe.
- (7) An oil burner for a Boiler.
- (8) Foundation for an electric motor, an oil engine and a pneumatic hammer. One of the drawings will be inked, traced and a ferro print taken.

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Final B. E. Examination.

MECHANICAL BRANCH.

37. Heat Engines II.

Heating Circuit.—Properties of steam, wet, dry and superheated internal energy of steam; use of steam tables. Carnot's cycle with steam as working agent. Entropy of steam. Temperature Diagram. Total heat Entropy diagrams. Expansion of steam, Rankine Cycle applied to steam and modifications. The indicator diagram, hypothetical and actual. Theory of steam engines. Uni flow, simple and multiple expansion engines. Actual performances of steam engines. Losses and methods of reducing them. Efficiencies and in practice. Engine trials. Heat balance sheet, variation of steam consumption with H. P. Governing.

Steam Nozzles.—Flow of steam through nozzle, velocity of expanding steam. Nozzle form and general relations for frictionless adiabatic flow. Effect of friction. Supersaturated flow.

Turbines.—Impulse and reaction pairs, work done by a pair, velocity diagram for axial discharge. Compounding for pressure and velocity.

Parson's reaction turbine. Velocity diagrams. Height of blades in reaction turbines. Increasing output and efficiency of turbines by reheating and bleeding of steam.

Engine Details.—Cylinders, pistons, valves, piston rods, stuffing box, gland and packing connecting rods. Crosshead and guides. Crankshaft, bearing and bed plate. Governors. Condensers and pumps. Lubrication and jacketing of cylinders.

Turbine details.—Shafts, reduction gear and blading; Nozzles and governor. Lubrication and jacketing of casing.

General layout of a thermal Power Station.

Valves and Valve gears.—Valves for stationary and locomotive engines. D'slide valves, piston valve and Meyers expansion valve; Link motion and radial gears; Corliss valve, Drop valve and trip gears. Valves for internal combustion engines. Poppet valve and sleeve valve, valves for air compressors. Valve Diagrams.

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38. Electrical Technology II.

(Common to Mechanical and Tele-Communication Branches).

A. C. Generators.—Single and polyphase: Construction, working and simple theory. Tests of efficiency and regulation by direct and indirect methods.

A. C. Motor.—Synchronous motor, construction, working and simple theory, current locus at constant voltage excitation, variation of current and power factor with changing excitation, heating and prevention. Polyphase induction motors; squirrel cage and slip ring types; simple theory, working and construction, rotating field: direct and indirect tests on performances, the circle diagram; methods of starting; Simple theory and operating features of the single phase induction motors, series motors and schrage motors.

Synchronous Converter.—Simple theory and operating features.

Measurements.—The Principle of construction, use and calibration of A. C. Instruments ordinarily employed. The Duddell oscillograph. The synchroscope. Single phase power factor meter.

Economics of Power supply.—Maximum demand, load factor, diversity factor, and their influence on the cost and generation. Systems of tariffs.

Transmission and Distribution.—Transmission and distribution of electrical energy. Calculation of size of conductors. General methods of erecting, laying and insulating.

39. Theory of Machines.

Kinematics and Pure Mechanism.—Definition of a machine, machine elements, links, chains and mechanism.

Constrained Motion.—Translation and rotation, instantaneous centres. Velocity and acceleration diagrams. Inversion of Mechanism. Quick return motion, slider crank chain.

Transmission of Power.—Wheel trains, simple, compound and epicyclic. Chain, belt and rope drives. Shaft couplings, flexible and fast couplings.

Friction of rest and motion.—Screw threads, journal and thrust bearings, ball and roller bearings. Clutches and brakes, work gear and cams.

Reciprocating Engine.—Velocity and acceleration of piston and connecting rod, inertial effects, turning moment diagram, flywheel; Balancing of Engines, Primary and secondary effects.

Theory of Governors.

Vibrations.—Free, forced, viscous, Damping.

Whirling of Shafts.—Torsional oscillations.

Gyrostatic action.

Stresses in thick cylinders.—Rotating discs.

Lubrication.—Properties of lubricants, testing types of lubricators.

40. Hydraulic Machinery.

(Common to Mechanical and Electrical Branches).

Water Turbines.—Pressure of a jet on stationary and curved vanes. Reaction turbines; outward, inward, axial and mixed flow. Pelton wheel, specific speed, speed regulation. The Francis and Kaplan turbine. General features of a hydro-electric plant.

Reciprocating Pumps.—Types, work done, slip and co-efficient of discharge. Effect of acceleration, slip and cavitation. Air vessels. Direct acting pumps. Deep well pumps.

Centrifugal pumps.—Whirlpool and Vortex Chambers, specific speed, turbine pump, Multistage pump.

Pumps—General.—Hand pump, Pulsometer Pump, Humphrey gas pump, Hydraulic ram and air lift pump.

Hydraulic appliances.—Hydraulic jack, riveter accumulator, intensifier, presses, cranes and lifts, valves joints, packings, meters, etc.

41. Fuels, Gas Plants and Boilers.

Classification of fuels.—Proximate and ultimate analysis. Physical characteristics, chemical composition and calorific value. Suitability for steam raising and industrial purposes.

Solid Fuels.—Peat, lignite, cannel, bituminous and anthracite varieties of coal. Production of coke, Indian coals, distillation of wood and production of charcoal with special reference to India.

Minor solid fuels.—Bagasse, spent tan, Nile Sud, straw, paddy husk, cocoanut fibre, etc. Pulverized fuel plant, general layout of the plant and its working. Burners for above.

Liquid Fuels.—A general survey of the countries from which liquid fuel is obtained. The economic aspect of liquid fuel.

Petroleum, Shale Oil, tar and tar oils. General characteristics and distillate obtained from above. Physical characteristics, chemical composition, calorific values and fuel consumption. Standard laboratory tests. Power alcohol and synthetic fuel.

Liquid fuels for steam raising purposes; general arrangement of air, steam and pressure system. Relative efficiencies. Burners for above.

Gaseous fuel.—Natural gas, oil gas, town gas, coke oven gas and blast furnace gas. Physical characteristics, chemical composition, calorific value and fuel consumption. Fuels, dopes, octane and cetane numbers. General ideas about the preparation of the gas. Pressure and suction gas plants. General layout and working for bituminous and non-bituminous fuels. Sampling and analysis of flue gases and exhaust gases.

Boilers:

Classification of Boilers.—Cylindrical fire tube and water tube; Marine and land types. High pressure and low pressure.

General details of vertical, Cochran, Lancashire, Cornish, Yorkshire, Galloway, Babcock and Wilcox, Stirling, Yarrow and Locomotive boilers. Bonecourt surface combustion boilers.

Boilers details.—Riveted joints, longitudinal and circumferential seams. End plate connections. Flues; Fox, Morrison, Deighton and suspended bulb corrugations. Manhole and hand hole. Caulking and fullering. Stays Gusset, bolt, tube stud, girder and sling.

Boiler accessories.—Economiser, Superheater, air preheater, feed pump, injector, steam trap, steam separator and feed water regulator.

Boiler Fittings.—Safety valves, steam stop valves, gauge glass fittings. Feed inlet valve and blow out valves.

Boiler Draught.—Natural, artificial, forced, induced, balanced. Howdens, Ellis and Eaves and closed stokehold system.

Mechanical Stokers.—Cocking, Sprinkling and Underfeed.

Boiler feed water.—A short description of the treatment of feed water. Mechanical filters.

Boiler Manufacture.—A brief description of the manufacture of a boiler, rolling of plate, flanging, processes, dishing of end plates and hydraulic forging of boiler plates. Universal drills, gang drills, pneumatic drills, pneumatic and hydraulic riveters. Board of Trade and Lloyds specifications. Hydraulic and steam tests.

Problem.—Equivalent evaporation of boilers draught, boiler trials and Heat Balance Sheet.

Boiler management and maintenance.—The economical use of fuel; automatic recorders; pressure feed water, draught and Co.

42. Workshop Practice.

Carpentry and Pattern Shops.—Hand tools, carpentry machines. Repetition work, Pattern making and core making.

Smith Shop.—Smithy tools and processes. Equipment and layout of a smith shop. Repetition work.

Ferrous Foundry.—Moulders tools, different types of moulding, moulding machines and repetition work, cupola management.

Non-Ferrous Foundry.—Melting, repetition work.

Metallurgy.—Ferrous metallurgy, steel and its alloys, their heat treatment.

Non-ferrous metallurgy, alloys and applications.

Fitting Shop.—Fitting tools and equipment.

Welding.—Gas, electric, examples of work, testing for soundness.

Machine Shop:

1. Lathe. Types, parts and description. Examples of work done, modifications for repetition work.
2. Drilling machine. Types and description, examples of work, modifications for repetition work.
3. Milling Machines. Types, parts and description, accessories. Examples of work done, fixtures for repetition work.
4. Shapers. Types, parts and description. Examples of work done.
5. Planers. Types and description. Examples of work done, various drives.
6. Slotting machines. Types and description. Examples of work done.

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(7) Presses. Types and description. Examples of work done.

8. Gear Hobbing machines and gear shapers. Types and description. Examples of work done.

9. Grinding machines. Types, parts and description. Examples of work done. Machine for repetition work.

10. Boring machines. Types and description. Examples of work done.

Tool Room.—Equipment, making of standard tools, special tools, jigs and fixtures. Tooling of Capstan and automatic lathes.

Metrology.

1. Measurement of lengths. Gauges, limits and tolerances. Comparators, and precision measurement.
2. Measurement of angles. Sine-bar and optical methods.
3. Gauging of shafts and holes, tapers and contours.
4. Gauging of screw threads.
5. Production of precision surfaces by grinding, honing, lapping and super finishing.
6. Checking of machine tools for accuracy and alignment.

43. Machine Design and Drawing III.

The students will design and prepare working drawing of the following:—

1. A single cylinder steam engine.
2. A high speed Diesel engine.
3. A 4-speed gear box for an automobile engine.
4. A 6"—Centrifugal pump.
5. A Belton wheel.
6. A Francis or a Kaplan Turbine.
7. A vertical Locomotive or a Lancashire boiler.

44. Quantity Surveying and Cost Analysis.

Approximate Estimates of Buildings.—Working out approximate cost (i) on Plinth area basis and (ii) on cube rate basis, with reference to cost of recently constructed structures in the neighbourhood.

Detailed Estimates.

Schedule of Quantities.—Standard methods of measurements and units of various items of work, taking out quantities for buildings (Sheds, residences, schools, Offices, etc.) of one or more floors, road work, abstract estimate.

Cost Analysis.—Standard schedule of rates and data. Leads and conveyance of materials. Preparations of detailed data for rates; lump sum provisions; Survey of a complete building including steel work, plumbing, and electrical fittings.

Estimating of Machine parts and structures.—Estimating cost of simple machines, steel framed structures, elevated tanks, cost of shops with shafting, counter-shafting, belting pulleys.

Specification, tenders and contracts.

General principles of valuation and rental cost of land and building.

30. Engineering Economics.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide Syllabus—Final B. E. Examination—Civil Branch.

31. Report Writing.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide Syllabus—Final B. E. Examination—Civil Branch.

Second B. E. Examination.

ELECTRICAL BRANCH.

11. Mathematics II.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide syllabus—Second B. E. Examination—Civil Branch.

12. Mathematics III.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide Syllabus—Second B. E. Examination—Civil Branch.

32. Applied Mechanics and Elements of Structural Engineering.

(Common to Mechanical and Electrical Branches).

Vide syllabus—Second B. E. Examination—Mechanical Branch

14. Hydraulics.

(Common to Civil, Mechanical and Electrical Branches).

Vide Syllabus—Second B. E. Examination—Civil Branch.

45. Theory and Calculation of Electrical Apparatus I

D. C. Generators.—Calculation of induced E. M. F. Armature windings. Armature reaction. Commutation, interpoles. Methods of excitation. Characteristics of shunt, series and compound wound generators. Losses, efficiency and temperature rise. Parallel operation with and without batteries. Rosenberg, three brush and arc-welding generators. Balancers and boosters.

D. C. Motors.—Calculation of torque. Back E. M. F. induced in motor armature. Load characteristic of shunt, series and compound motors. Swinburne's test. Testing pairs of similar series and shunt motors. Starter and field regulators, speed control of D. C. motors, starter calculations.

Acid and Alkaline Batteries.—Installation and first charge. Charging equipment. Milking booster. Capacity and efficiency tests. Care and maintenance.

A. C. Circuits.—Solution of series, parallel and series parallel circuits. Current and voltage resonance. Locus of current in series circuits.

Single Phase Transformers.—Theory of operation, Mutual and leakage fluxes. Expression for voltage induced in primary and secondary. Types and construction. Vector diagram. Equivalent circuit. Determination of constants in equivalent circuit by open-circuit and short-circuit tests. Pre-determination of performance. Kapp's diagram. All-day efficiency. Temperature rise and methods of cooling. Sumpner's test for determining efficiency and temperature rise. Parallel operation. Auto-transformers, comparison with two binding transformers. Instrument transformers.

Polyphase currents and circuits.

Polyphase transformers—Type and construction. Three phase connections. Third harmonic in phase voltages, Tertiary winding.

Auto-transformer. Transformation from three phase to single phase, two phase, six phase. Paralleling and parallel operation. No-load and on-load tap changing. Induction and moving coil voltage regulators.

46. Industrial Electronics and Elements of Telegraphy, Telephony and Radio Communication.

The electron and its properties, gaseous conduction, arc and glow discharge. Thermionic emission types of emitters; space charge. An elementary study of characteristics of diode, triode, tetrode, pentode, thyatron, high voltage rectifiers; and their applications to industry. Cathode ray tubes. Photo cells and their applications.

Telegraphy.—Elementary theory of direct current telegraph transmission. Effects of inductance, capacitance and resistance. Single and double current working. Simple ideas upon the frequency band width required for telegraph working, relation between speed of signalling and band width. The operation of a number of telegraph channels over a single circuit using carriers which can be segregated at the ends of the circuit.

The use of filters, composited circuits. The morse and five unit codes. The Band.

Telephony.—The nature of sound. The conversion of sound energy to electrical energy and *vice versa*.

The construction and simple theory of such apparatus as the following:—

Receivers, Transmitters, Induction coils, Repeating coils, Resistors, Inductors, Condensers, Indicators, Magneto-generator, Vibrator, Bells, Relays, Protective devices.

Simple telephone sets, local and central battery types.

Radio Communication.—Detecting devices for small alternating potentials; contact rectifiers and valves.

Construction and action of telephone receivers and electromagnetic loud speakers.

High frequency and low frequency thermionic amplifiers, essential principles of action. Causes of distortion.

Simple circuits of radio receivers including use of retroaction. Qualitative ideas of Selectivity. Telegraph and telephone instruments and fittings in common use; telephone exchange and switch boards. Simple magneto and C.B. Types.

47. Heat Engines I.

(Common to Electrical and Tele-Communication Branches).

Thermodynamics.—Units of heat. Heating and expansion of gases. Internal energy of a gas. Laws of perfect gases. Air cycles. Carnot's, Otto, Diesel and Dual combustion cycles. Entropy of gases.

Internal Combustion Engines.—Gas and Petrol Engines, Oil Engines, Diesel and semi-Diesel Engines. Working and features of two and four stroke cycles. Efficiencies and engine tests.

Air Compressors and Motors.—Single and multistage compressors. Inter cooling. Circulation of power. Dimensions of cylinders, and efficiency. Conditions for maximum efficiency. Effect of clearance. Overall efficiency. Mechanical details. Fans and blowers.

Refrigeration.—General Principles—Types of mechanical refrigerators. Vapour compression refrigerators. Choice of vapours for commercial refrigerators. Comparison of working fluids, calculation of power required and co-efficients of performance. Rating, testing, mechanical details. The use of entropy diagrams for refrigeration problems. Applications of Refrigeration—Principles and methods of air conditioning.

Engine Details.—Details of Engine and Engine Parts.

48. Electrical Designs and Drawing I

(Common to Electrical and Tele-Communication Branches).

D. C. Machines.—Magnetic and specific electric loading. Output coefficient. Effect of number of poles on general design. Ratio of Pole Arc to Pole pitch. Determination of the main dimensions. Mean E. M. F. induced per conductor. Number of conductors. Number of slots. Design of slot. Winding diagram. Final dimensions of core length. Design of poles, yoke, air gap. Field windings. Inter-poles. Commutator. Brushes. Armature reaction Regulation and series winding. Calculation of the open circuit characteristic.

Transformers.—Output, specific loadings, Design of core section and number of turns. Coils and insulation. Magnetising current. Cooling. Losses. Calculation of efficiency and regulation.

20. Building Drawing.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide Syllabus Second B.E. Examination—Civil Branch.

Final B.E. Degree Examination.

ELECTRICAL BRANCH *sub cap*

49. Heat Engines II.

Im Properties of steam, wet, dry and superheated. Internal energy of steam. Use of steam tables. Carnot's cycle with steam as working agent. Entropy of steam. Temperature entropy diagram. Total heat entropy diagrams. Expansion of steam. Rankine cycle applied to steam and modification. The indicator diagram, hypothetical and actual. Theory of steam engines. Uni-flow simple and multiple expansion engines. Actual performance of steam engines. Losses and methods of reducing them. Efficiencies in practice. Engine trials. Heat balance sheet, variation of steam consumption with H.P. governing.

Q *Steam nozzles.*—Flow of steam through nozzles, Velocity of expanding steam. Nozzle form and general relations for frictionless adiabatic flow. Effect of friction. Supersaturated flow.

Turbines.—Impulse and reaction pairs, work done by a pair. Velocity diagrams for moving blades. Blade friction, The De Laval Turbine. Impulse turbine with several blade rings. Velocity. Diagram for axial discharge. Compounding for Pressure and velocity. Parson's reaction turbine. Velocity diagrams. Height of blades in reaction turbines. Increasing output and efficiency of turbines by reheating and bleeding of steam. Diagram for axial discharge. Compounding for pressure and velocity.

Details.—Details of Engine, Steam turbine and parts.

40. Hydraulic Machinery.

(Common to Mechanical and Electrical Branches).

P28 Vide Syllabus—Final B.E. Examination—Mechanical Branch.

50. Theory and Calculation of Electrical Apparatus II.

45 *Alternator.*—Types and construction. Methods of producing sinusoidal voltage. Single and polyphase armature windings. Expression for induced voltage. Harmonics. Advantages of Star connection. Rotating flux of polyphase armature. Armature reaction. Leakage flux. Load characteristics, Behn-Eschenberg's, Rothert's and Potier's theories. Predetermination of regulation. Simple two reaction analysis. Synchronising and synchroscopes. Synchronising torque. Parallel operation.

100 *Synchronous Motor.*—Theory of operation. Vector diagram, current locus and characteristics and constant excitation and applied voltage. Stability, Predetermination of performance. Variation of current, power factor, efficiency and pull-out torques with excitation. Synchronous condenser. Hunting and its prevention. Methods of starting. *29*

Single phase Commutator Motors.—Theory of operation, construction, vector diagram and characteristics of uncompensated and compensated series motors. Shunt and series commutating poles. Methods of starting, speed control and power factor. Comparison of A.C. and D.C. series motors. Uncompensated repulsion motor.

Polyphase Induction Motors.—Theory of operation and construction of squirrel cage and slip-ring types. Vector diagram. Equivalent circuit. Expression for torque. Starting torque. Maximum torque. Slip-torque characteristics, Starters. Load Characteristics. Circle diagram, Pre-determination of performance. Theory of operation and characteristics of double squirrel cage motor. Speed control by resistance in secondary, pole changing and cascading. Theory of operation and characteristics of phase, advancers, Schrage motor.

45 *Single Phase Induction Motors.*—Resolution of Single phase flux into two rotating fluxes. Operation. Theory of operation and characteristics of split phase, capacitor and repulsion start induction motors.

Rotary Converters.—Synchronous converter. Theory of operation. Voltage and current ratios. Wave form of current in various coils. Armature copper loss. Efficiency. Armature reaction and commutation. Comparison with D. C. Generator. Theory of operation, Starting and characteristics of motor-converter, Power transformed mechanically and electrically.

Rectifiers.—Mercury arc rectifier. Theory of operation. Transformer connections. Characteristics. Current and voltage ratios and wave forms. Protection and voltage control by grid bias. Theory of operation and characteristics of copper oxide and hot cathode rectifiers. Thermionic valves.

51. Electrical Theory and Measurements.

Electrical units and standards. Relation between C.G.S. and the practical electrostatic and electromagnetic units. Standard cells, standards of luminous flux, Candle Power and Illumination. Self and mutual inductance; capacitance self and external.

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Alternating current theory.—Symbolic, vector methods and "complex" quantities and their application to practical cases *i.e.*, polyphase circuits and alternating current networks. Inversion and application to simple circuits. Harmonics in single and polyphase circuits. Properties of rotating fields. Simple cases of transient phenomenon.

Methods of Electrical Measurements.—Theory and practice of modern test methods for the measurement of electric and magnetic quantities. Ballistic tests; flux meters. Continuous and alternating current potentiometers. Watt meter measurements. Direct current bridges; the Wheatstone, the Carey Forster and the Kelvin bridges. Measurement of high and low resistance. Alternating current bridge measurements of effective resistance, and reactance, the Schering bridge, and the Heaviside Campbell bridge. Frequency measurement. Oscillographs for high and low frequencies. Measurement of magnetic properties of iron. Iron loss measurements by Watt meter; Epstein tester. Measurement of dielectric properties. Measurement of luminous flux, candle power illumination. High voltage testing.

Electrical Measuring Instruments.—Moving Coil, Moving Iron, electrostatic, thermal, dynamometer and induction types. Energy and kVAh meters, Ohm meters, Megger. Frequency meters. Power Factor Meter. Synchroscope. Maximum demand indicator. Electrical pyrometers.

52. Generation and Utilisation.

Generation.—Fixed costs and working cost of generation. Straight line and sinking fund methods of depreciation. Maximum demand, load factor, systems of tariffs, Choice of site of station. Choice of prime movers and number and size of units. Combined steam and hydro-plants. Inter-connected stations.

Cooling system for generators. Protection against fire. Objects and methods of earthing the neutral. Protection relays. Excitation systems. Voltage control. Switch gear. Short circuiting of generators. Current limiting reactors. Frequency and power factor control.

Utilization.—Electric Drive—Comparison of electrical and mechanical drives. Individual, group and semi-group drive. Costs and characteristics of various types of A.C. and D.C. constant and variable speed motors and their industrial applications. Economic choice of motor. Choice between generating power in factory and purchasing from Electric supply company.

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Electric Traction.—Direct current and single phase systems. Motor characteristics. Sub-stations Current collection. Manual and automatic controllers. Locomotive, motor coach and multiple unit trains. Diesel-electric traction. Mechanics of train moment. Energy and speed time calculations.

Illumination.—Filament and gaseous discharge lamps and their characteristics. Shades and reflectors. Design of factory lighting and interior illumination of buildings. Street lighting.

Electric furnace and Electric Chemical Industry.

53. Transmission and Distribution.

Transmission systems. Electrical and Mechanical properties of conductors, Corona. Construction of high voltage underground cables. Potential stress losses and faults in cables. Types and construction of insulators. Voltage distribution in a string of suspension insulators. Grading rings. Arcing horns. Insulator testing. Porcelain, oil filled and condenser bushings. Performance of short and long lines. Voltage regulation. Power circle diagrams of constant voltage lines. System stability. Isolated and grounded systems. Arcing ground and Peterson coil. Calculation of short circuits in transmission lines. Circuit breakers and protection of short circuits in transmission lines. Circuit breakers and protective relays. Travelling waves, Lightning arresters. Transposition of lines.

Loading and strength requirements of conductors. Sags and stress in conductors with supports at same level. Effect of temperature variation. Sags and stress in conductors with supports at different levels: The Thomas chart and its use for sags and stress determinations. Design and calculation for wooden poles, steel poles, steel towers, guys, and struts and cross arms.

Comparison of D.C. two wire and three wire A.C. single phase two phase and three phase systems of distribution. Primary and secondary distribution. Calculation of voltage drop in conductors for concentrated and distributed loads. Determination of insulation resistance and location of faults.

54. Design and Estimate of Electric Supply Systems.

Buildings.—Approximate estimate of buildings for Power and Sub-Stations.

Transmissions Line Materials.—Design of distributors, poles and structures—Design of transmission lines and structure—Approximate estimate for small transmission and distribution systems:

Electrical Machinery.—General principles relating to specifications, tender and contract for Power and Sub-Station equipment—valuation and depreciation of electrical equipment.

Provisions of the Indian Electricity Act.—Project Design and estimation of a small town electrification scheme.

55. Design and Drawing II.

Alternators.—Low speed, medium speed, and Turbo-alternators. Output co-efficient. Main dimensions. Stator winding. Design of slot. Design of field systems. Essential features in the construction of the stators and rotors.

Induction motor.—Calculation of main dimensions. Stator winding. Rotor slip-ring and squirrel cage. Magnetising current. Efficiency.

30. Engineering Economics.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide—Syllabus Final B.E.—Civil Branch.

31. Report Writing.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide—Syllabus Final B.E.—Civil Branch.

Second B.E. Examination.

(TELE-COMMUNICATION BRANCH.)

11. Mathematics II.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide—Syllabus Second B.E. Examination (Civil Branch).

12. Mathematics III.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide—Syllabus Second B.E. Examination (Civil Branch).

56. Applied Mechanics and Elements of Structural Engineering.

1. Deflection of framed structures—Maxwell's and Castigliano's theorems. Rankine's Theory of Earth Pressure and applications to Foundations—Rebhann's construction.

Stress analysis and design of transmission towers and poles.

Stability of Masonry structures such as walls, low dams.

Theorem of three moments.

2. *Graphic Statics.*—Graphical solutions for pressure on retaining walls and masonry structures. Stresses in transmission towers. Truss deflection by graphical methods.

3. Elementary Structural Engineering.—

(a) *Reinforced concrete.*—Properties of concrete and reinforcements—Testing—general principles of designs of lintels, beams, slabs, columns and column footings. Shear, bond, and diagonal tension, its nature, evaluation and location of reinforcement.

(b) *Structural Steel.*—Design of beams, H-columns and column bases and roof trusses.

4. Principal stresses and Principal planes, simple applications. Strength and stiffness of shafts of circular sections under pure torsion.

Oscillations of elastic systems (elementary). Terminal oscillations of shafts—whirling of shafts—balancing.

5. *Testing.*—Tests on mild steel, cast iron, brass, copper, gun metal, wood, etc., for tension, compression and torsion. Determination of elastic constants, use of strain measuring devices—tests on fatigue of materials bonding, hardness and impact tests. Tests on wire ropes, springs, chains, insulators. Tests on columns.

57. Engineering Electronics I.

The electron and its properties, gaseous conduction, arc and glow discharges. Thermionic emission, types of emitters, space charge. Characteristics of the diode, triode, tetrode and pentode, their application, distortion, output and efficiency.

35. Electrical Technology I.

(Common to Mechanical and Tele-Communication Branches).

Vide—Syllabus Second B.E. Examination (Mechanical Branch).

72

46

48. Design and Drawing I.

(Common to Electrical and Tele-Communication Branches).

Vide—Syllabus Second B.E. Examination (Electrical Branch).

47. Heat Engines.

(Common to Electrical and Tele-Communication Branches).

Vide—Syllabus Second B.E. Examination (Electrical Branch).

20. Building Drawing.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide—Syllabus Second B.E. Examination (Civil Branch).

Final B.E. Degree Examination.

TELE-COMMUNICATION BRANCH.

58. Engineering Electronics II.

Vacuum tube oscillators; typical circuits; frequency stability and the use of quartz crystals, etc. Cathode ray tubes and their simple applications.

59. High Frequency Measurements.

Sources of supply, standards and auxiliary apparatus; measurements of current, voltage and frequency; wave meters and frequency standards. Measurements of circuit constants, resistance, inductance, capacitance and mutual inductance. Antennae and feeder measurements; field strength measurements.

60. Transmission Circuits.

Elements of Circuit Theory.—Linear circuit analysis with lumped constant transient and steady states; forced and free oscillations; resonance, selectivity and decrement; coupled circuits; applications in audio and radio frequency engineering.

Networks and Filters.—Network theorems; superposition, artificial lines, attenuators, equalisers and wave-filters. Four terminal networks, image and iterative parameters; termination, loss and reflection. Transmission line equivalents.

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61. Broadcasting I (Reception).

Problems of reception; signals; fading and distortion. Receiver requirements; types of receivers and their behaviour; automatic gain control, selectivity, power supplies. Special receivers such as for diversity. Receiving antennas.

62. Broadcasting II (Transmission).

Wave propagation; attenuation and coverage; echoes, fading, skip distance, etc., indirect ray and its behaviour; atmospheric and man made disturbances. Transmission standards. Optimum frequency and power considerations.

General requirements of transmitters, different types of power supplies and their relative merits. Typical circuits of low, medium and high power transmitters.

Methods of modulation, types of signals, low and high power modulation, carrier and single side band suppression, frequency and phase modulation.

Antenna systems, directional antennas, antenna arrays and mast radiators; current and voltage, distribution. Typical installations. Feeders, simple theory of surge impedance, matching, etc.

Studio acoustics, speech and bearing, noise levels, reverberation and their optimum for studios, acoustic materials and their uses; typical installations.

63. Wire Communication I (Telegraphy).

Conductors used for local, short and long distance working poles, cross arms and insulators. Manual working, instruments, keys, sounders, relays, etc. Single and double current systems, quadruplex circuits; central battery working, long distance working repeaters and loading. High speed automatic working. Single and multiple channels. Wheatstone automatic, simplex and duplex. Bandot transmitting, repeating and receiving apparatus. Teleprinter.

64. Wire Communication II (Telephony).

Speech and hearing, requirements of commercial communication. Decibel and neper notations. Electro-acoustical instruments. Telephone lines and cables. Transmission theory, attenuation and propagation constants, characteristic impedance, conditions for distortionless transmission, cross talk. Manual, magneto, CBX and CB systems.

Subscribers and exchange apparatus. Automatic telephony. Single and multi-office working; long distance working, loading, repeaters and equalisers and echo suppression. Transposition arrangements.

38. Electrical Technology II.

(Common to Mechanical and Tele-Communication Branches).

Vide—Syllabus Final B.E. Examination (Mechanical Branch).

30. Engineering Economics.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide—Syllabus Final B.E. Examination (Civil Branch).

31. Report Writing.

(Common to Civil, Mechanical, Electrical and Tele-Communication Branches).

Vide—Syllabus Final B.E. Examination (Civil Branch).

Special

758
Edn and P.H. Dept
Memo. No. 31443A-1/49A Edn. d. 27-4-49.
Eng. colleges - Duration of course.
3

The S. G. P. is requested to print and supply to this dept 125 copies of the enclosed letter with the annexure. The matter should be treated as specially urgent.

16/1/48
2/2/48
To the S. G. P.
(By Special messenger)
27/4/48

Note—Mr. Govindaraja Sanyal has to be supplied with 100 copies. It is better to have a reserve of 25.

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Eqm. 1000 6 H-5040

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 of the letter enters
 any the requested
 Edm and P.H. Dept

Special

79 5 E.P.H.(A)

Memo. No. 31443A-2/49A Edu. dated 31-5-49.

Sub: Colleges - Sugg. - Duration of course shortening.

Ref: Memo. No. 31443A-1/49A Edu. d. 27.4.49

p308

Desjod.
31/5

The S. G. P. is requested to supply immediately 125 copies (printed) of the enclosure to the memo referred to above, ~~with~~ any further delay.

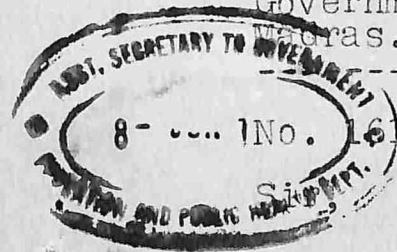
To the S. G. P.

31.5.49

31/5/49

31/5/49

To
The Secretary to Government,
Education and Public Health
Department,
Fort St. George, Madras.



8- ... No. 161/2 BK

Dated 7.6.1949.

Sub: Colleges - Engineering - Duration of
Course - Shortening -
Ref: Government Memo. 31443-A-1/49-A Education,
dated 31.5.49.

As the above work appears to be a Technical Publication, it is proposed to submit a proof of the work to Government for approval before striking final copies. Special arrangements have been made to expedite the work and submit the proof by the end of this week or earlier, if possible.

A. V. C.

~~Dea Superintendent~~
r/lb.

E. P. H. (A)
the S. J. P. maybe
reminded, if
necessary on
21.6.49.

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Routine

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E.P.H.-1

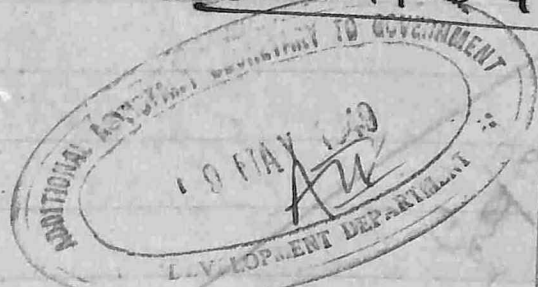
Informal approach
was of no avail.

The Dev. Dept. may be requested
to link hereto their file bearing
c. no. 69698 A IV / 48 referred to on
p. 10 n.f. for Secretary's reference.

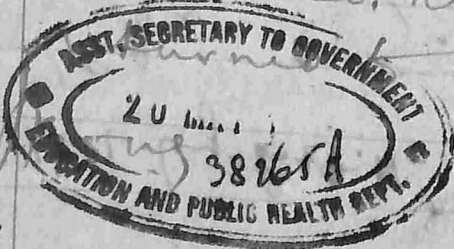
19.5.49

E.P.H. u.o. 29007A-6/49A

dated 19.5.49



Dunt no 52980 AT
49-10/20.5.49 with
LF 69698A IV / 48.



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Dev. Dept

The file referred to above
is linked below. This may be

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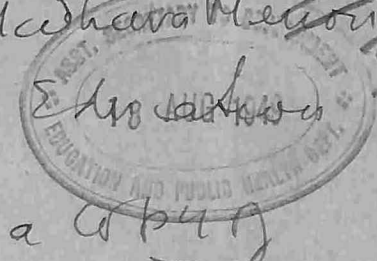
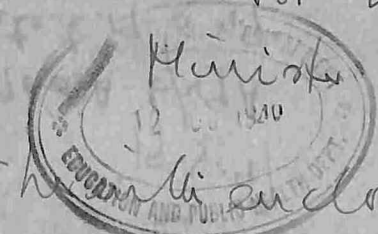
N. GOVINDARAJAN
RETD. CHIEF ENGINEER.

E.P.H.

85
66, LLOYD ROAD, ROYAPETTAH.
Madras, 30-7-1949

20 Due Honble for K. Madhava Rao

Dear S. 52001



I herewith enclose a copy of
a letter I have sent today to the
Secretary, Tech. Education Committee.
for your information & such action as you may
consider necessary. Yours faithfully
N. Govindarajan

Madras, 29th July 1949.

From

Sri N. Govindarajan, B.A., B.E.,
Retd. Chief Engineer,
66, Lloyd Road, Royapettah, Madras.

To

The Secretary,
Technical Education Board,
Engineering College, Quindy.

Sir,

With reference to the resolution passed at the 4th meeting
of Standing Board of Technical Education held on 7th February 1949
I have to make the following report.

2. I met the Hon'ble Mr. A. B. Shetty on or about 25th of
April and gave him a letter - copy of which is enclosed.

I have not so far heard from the Government in the matter
of printing this letter with its enclosures and sending it to
the various addressees mentioned in the draft letter. I also
casually met Mr. Lobo and mentioned to him how that this letter
of mine was pending with the Government in his Secretariat.

The Technical Education Board was particular that the
universities in the Inter University Board should be addressed
and if possible brought round to the view contained in this
draft letter. In my personal view the really competent men who
can have a say on this subject are the Chief Engineers and this
Technical Education Board and not so much the Universities and
the Inter University Board. Whatever it may be I feel that no
further time should be lost in issuing this letter and making
an attempt to convert the Universities and the Inter University
Board to this view, so that the 3 year course may start at least
from 1950 July.

3. A committee with me as Chairman was formed to go into
the details of the prognostic tests that may be set for students
seeking admission into the Engineering Colleges. One meeting
of this committee was held on 11th March 1949 and Dr. Boas was
requested to prepare a note and suggest suitable tests. The
idea is to get some students of the Engineering College

Engineering as apart from what they might have picked up from their contact with Engineering Works and machines.

When I reminded Dr. Boaz both by letter and on the telephone, he was unable to furnish a note and expressed his regret and seems to have since left on foreign deputation. I therefore suggest that the Government might be requested to co-opt Mr. Phillips, Research Officer, All India Radio, Madras. On having the Government's permission to so co-opt him I shall hold a meeting of the Committee and have further consultations on this subject. However Dr. Boaz mentioned to me that he would have some very useful suggestions to make based on the contacts he will make with the foreign universities in his deputation. So some final conclusions on this subject can be had only by the end of this year or early next year after Dr. Boaz returns from his foreign tour. In the matter of holding evening classes to enable men with aptitude in engineering to obtain university degrees without undergoing 3 or 4 years regular course in an Engineering College I have not taken any steps so far. If at all, these classes can be instituted only from 1950 onwards. It is my view that these evening classes should be so organised that they will enable men with S.S.L.C. qualification already in employment as clerks, artisans etc. to attend these classes over a period of 2 to 4 years at the end of which they should be able to take the Institute of Engineers Test for Associate and full membership and/or the B.E. and B.Sc. degree examinations of the University. I am not however confident that we can find enough teaching personnel to undertake such continuous evening classes atleast for some years to come. I am also of the view that our resources in the matter of teaching personnel etc. should be used primarily in the numerous colleges already started and should not be frittered away in starting fresh courses of Engineering education. I should like to have a direction in this matter from the Government before I convene a meeting of the Committee.

Our people all await for the Government's response in the matter

of issuing the letter already drafted in regard to the reduction of the 4 year course to 3. That will help me to know that the delay with the Government in taking action in my draft letter does not indicate any change in their policy.

I am sending a copy of this letter to the Minister for Education, the Hon'ble Sri K. Madhava Menon.

Yours sincerely,

sd. N. Govindarajan
(N. GOVINDARAJAN).

Encl: 1 copy of letter.

Copy to Hon'ble Sri K. Madhava Menon, Minister for Education for information.

W. Govindarajan, B.A., B.E.,
Retd. Chief Engineer P.W.D.

66, Lloyd Road, Royapettah,
Madras, dated the 25th April 49.

Dear Sir,

The enclosed draft has been made by me
in consultation with M/s. G. Sundaram and Paul as
directed in the Resolution of the Board of Technical
Education. I have to issue it with a copy of the
syllabus to all the Universities in India and to
Governments and other institutions. The syllabus
was printed by the University but Mr. Paul has been
unable to get copies. So that has also to be
printed. I request that 100 copies of the letter
and 100 copies of the syllabus may be printed and
supplied to me for issue.

Yours sincerely,

Sd. N. Govindarajan.

To

The Hon'ble Mr. A. B. Shetty,
Minister for Education, Fort St. George, Madras.

/True copy/

From

Sri N.Govindarajan, B.A., B.E.,

Chairman, Technical Education Committee,

66, Lloyd Road, Royapettah, Madras.

To

1. The Secretary,
Inter Universities' Board,
10-A, Cavalry Lines, Delhi.
2. The Registrar, University of Madras, Chepauk.
3. do. Annamalai University, Chidambaram.
4. do. Andhra University, Kakinada.
5. * The Registrars of other Universities.
6. The Secretary, Institute of Engineers, Madras.
7. The Secy. to Govt., (East Punjab, Amritsar.
Education Dept.) East Bengal, Calcutta.
Public Works Dept. (Orissa, Cuttak
Industries Dept.) C. Provinces, Nagpur.
U. Provinces, Alahabad.
Bihar, *patna*
Madras
8. The Secy. to the Govt. of India
Education Department. | New Delhi.
Works, Mines & Power
9. The Secy. to Government, (Mysore.
Education Department.) Hyderabad.
Public Works Dept.) Travancore.
Industries Dept.) Baroda
Bopal
Jaipur.

*addresses to
be noted

Sir,

Subject: Reduction of the undergraduate
course in Engineering from four
to three years in the Colleges
in Madras Province.

I am desired by the Standing Advisory
Board for Technical Education of the Government
of Madras to address this letter to you advocating
early substitution of a three year undergraduate
course in Engineering in place of the existing
four year course in the Colleges in India.

This body has the Hon'ble Minister for Education as its President and has Members the Chief Engineers of the Madras Government, Chief Engineers of the M. & S.M. and S.I. Railways, some members of the

Madras Legislatures, the Director of Public Instruction,

College Principals, ^{of the Eng. Colleges in the Madras Presidency under the Madras, Andhra, and the P. & A. Universities} a representative of the Madras University, ^{+ P. & A. Universities}

the Director of Industries, and some representatives

from the major industries. Such a step to reduce the period is recommended for the reasons discussed below and I shall be grateful if the matter is taken up for active consideration

by the Inter University Board
by your University
by the Institute of Engineers
by Your Government

It has been felt for some years in Madras Province that to provide enough number of engineers to carry out the urgent postwar reconstruction programmes in hand, new colleges were urgently necessary and four new ones were accordingly started in 1945. Examination of the syllabus for the engineering course indicated that it included some items which had been covered already in the Intermediate course and were hence unnecessary. On the other hand, some very desirable subjects like Engineering Economics did not find a place in it.

Furthermore it was felt that there were far too many holidays and that it was possible by reducing the number of holidays to curtail the four year course to three years without loss of efficiency.

On examining the practice in other countries it was found that in 22 Universities out of 28 for which information was available, the normal engineering course after matriculation was only

three years and only 6 universities had four year course - vide Annexure I. Qualification for admission into the Engineering Course in India is a pass in the Intermediate Examination and this is considered at least equal to if not superior in standard to London or other foreign Matriculation examination. So there ~~was~~ appeared no reason why a longer course than three years should be required in India.

Also in a poor country like ours it is extremely desirable to limit the period of professional course to what will be necessary to secure the desired standard and quality of education. Such a step will not only result in economy to the State but ^{will} also minimise the cost to the student and his parent.

A committee formed under the auspices of the Technical Educational Board went deeply into this question and recommended the reduction of the course from 4 to 3 years and also framed a suitable syllabus and in doing so provided 180 working days in the year against the present 160 working days. It was its carefully considered opinion that the revised syllabus in which were omitted certain unnecessary items and were added some new subjects like Engineering Economics and Writing of Reports was adequate for the Degree course and could be completed within three years without any impairment of efficiency or strain on the students.

A copy of the revised syllabus for the 3 year course is enclosed herewith for your information.

The Committee further recommended that with a view to provide the highest possible instruction in Engineering, a post graduate course of one year leading to M.Sc. degree should also be instituted, in addition to the existing M.Sc. degree obtainable by submission of the ~~It also~~ They also recommended that facilities should be provided in the Engineering Colleges for research

leading to M.Sc. and Doctorate Degrees in Engineering.

In the meeting of the
The Standing Advisory Board for Technical

Education of the Government of Madras in their meeting

held on December 1948 accepted these recom-
mendations. *The resolution to shorten the existing 4 year Engineering course to 3 years was put to the vote & carried by an overwhelming majority.*

The Board of Studies of the Madras Univer-
sity *also* examined these proposals, accepted them and
forwarded them to the Academic Council of the
Madras University for further action to implement
them.

At this stage, the Board *of Tech. Edu.* finds its labour
in this respect is likely to be frustrated by the
view taken up by the Academic Council of the Madras
University *(at its meeting held in Feb. 49)* and by a possible erroneous interpreta-
tion of a Resolution of the Inter Universities Board.
To quote this Resolution and to reproduce what
appeared in the papers about the Academic Council's
discussion and view.--

(1) Resolution of the Inter Universities Conference.--

"This Conference is of opinion that the minimum
period of training for a degree in Engineering should
not be less than 4 years but during the course, periods
of practical training may also be included."

(2) Extracts From the "HINDU" dated 19th February
1949 p.5 - Amending Madras 'Varsity Act - Academic
Council's discussion -

B.E. Degree course.

"Mr. T. Totadri Iyengar moved that no change be
made at present in the regulations governing the B.E.
Degree course. He stated that the suggestion for the
reduction of the period of the degree course in Engi-
neering from four to three years came up on the
recommendation of the Standing Advisory Board for
Technical Education of the Government of Madras. The
Board of Studies in Engineering of this University
considered the suggestion and resolved to reduce the
course from four to three years and framed the necessary
regulations and syllabuses. Meanwhile the Standing
Committee of the Academic Council considered the
resolutions passed by the Inter Universities' Con-
ference on the subject. The Conference was of opi-
nion that there should be uniformity in regard to
the duration of the Engineering Degree course in the
Universities. It also expressed the opinion that
the minimum period of training for a degree in Engi-
neering should be not less than four years, but, during
this course, periods of practical training might be
included. Should be practical training be not inclu-
ded

** Mr. Paul - If
the resolutions
of the Tech.
Edn. Board are
clear in
their accept-
ance then the
resolutions
also can be
noted here
by you from the
records avail-
able with you.
If so this sen-
tence will
have to be
added as
follows.-
"and passed
the follow-
ing resolu-
tions."

*The 3 year syllabus to be
in consonance with the rules &
regulations of the University of
Madras & put the proposal up
for further implementation.
A copy of this syllabus is
enclosed for your information.
In the meeting of the Academic
Council of the Madras
University, the resolution
to introduce the 3 yr
shortened course instead
of the present 4 yr course
from the Academic year
48-49 was moved by the
Secy of the Standing
Advisory Bd for Tech. Edu.,
Mr. C. S. Paul. The same
was duly seconded. An
amendment that the course
of the 3 yr course be deferred
to the next meeting of the
Academic Council to be held
in Feb. 49 was moved by
one of the members & was duly
seconded. The members had
their chance to express
their opinion on the three
yr. course, & there was a
considerable discussion
in which the majority of the
members of the Academic
Council took part. The
amendment was put
to the vote & carried.*

included or be not sufficient an additional
period of practical training of not less than
180 days should be required after the candidate
had finished his four-year degree course. Mr.
Totadri Iyengar stated that in almost all the
Universities in India the period of the course
was four years. Only in three Universities, namely,
Aligarh, East Punjab and Osmania Universities they
had three year courses. It had been found that
in America and in some other countries, the
minimum period of training was four years. It
was thought that the reduction of the course might
lead to the lowering of the standard. He said
that there had been constant changes in the sylla-
bus for the degree course, and he felt that, in
view of the resolution passed at the Inter-Uni-
versity Conference it was not advisable to reduce
the period of the course.

Mr. G. R. Narayana Aiyar seconded the motion.

Need for Uniformity.

The Acting Vice-Chancellor stated that the
Inter-Universities Conference thought it desirable
to have uniformity in regard to the duration of the
course. An expert committee considered the matter.
By passing the resolution moved by Mr. Totadri
Iyengar, they were not completely shelving the
question. The Vice-Chancellor had told him that
he intended to convene a conference very soon of
representatives of the various engineering institu-
tions for the purpose of further examining the
details, as there was need for training more men in
this profession. The details would be considered
then and, if a change was necessary, it would be
brought up again.

Lt. Col. S. Paul said he was in favour of having
a three year course. The present course was a
four year course without any practical training.
The profession was a growing one and the syllabuses
had to be changed often if they should be abreast
of the times. The need for a greater number of
engineers was keenly felt and the course could be
reduced without impairing the efficiency of the
course. He was sure that with a shorter period, the
standard of instruction would be better. The
suggestion to have a shorter course was made by the
Scientific Man Power Committee of the Government of
India, to meet the growing needs of the country and
the All-India Council of Education had also approved
it. As one connected with teaching the subject,
he would say that a lot of unnecessary things were
being taught to students now. With increased
number of working days and with useful subjects, the
course could be reduced to three years without risk
of lowering the standard of efficiency.

Mr. P. Mahadevan stated that the resolution
before the House was not definite. He could not
understand whether the four year course suggested
the Inter Universities Conference included practical
training or not. He was also of the opinion that
the course could be shortened, if suitable candi-
dates were selected for the course.

Practical training.

The Acting Vice-Chancellor stated that the
question of fitting in the period of practical
training within the four-year period would be
considered by the Conference to be convened.

Mr. P.R.Ramaswami said that by reducing the period of the course, the standard would not be affected. Practical training was the most important part in training, and what they had to teach by way of principles in classes could be done within a limited period.

Mr. Mathews Tharakan doubted the wisdom of reducing the course to three years.

Mr.K.Balasubramania Aiyar asked whether it would be possible to produce efficient engineers in a shorter course than at present.

Lt.Col.S.Paul stated that engineering could best be learnt in the field and not in classes. He thought that, by having a three-year course, they could meet the exigencies of the service in the country.

After some more discussion, the motion of Mr.T.Totadri Iyengar that no change be made for the present in the regulations governing the B.E.Degree course was passed, 43 voting for and 14 against the motion. "

The case for shortening the course can be summed up as follows.---

(1) It is certified ^{including the Principals & Professors of all the Eng. colleges} by all the Members of the Engineering profession in this Province that the shortening of the course to 3 years worked along with the revised syllabus and the increase in teaching hours will not result in the lowering of the standard. All that the Board has done in revising the syllabus is to weed out some of the routine and mechanical features found in the old syllabus and to add a few.

(2) The Technical Man-Power Committee of the Government of India asked that the 4 year degree course of Engineering Colleges should be shortened to 3 years. The Standing Advisory Board for Technical Education would ask that its recommendation in favour of shortening the course should be read together with its other recommendations for instituting M.Sc. and Doctorate degrees. The proposals form an integrated unit. The Board is assured that while the B.E. degree will retain standard unimpaired the larger scope allowed for

M.Sc. and Doctorate degrees will produce men who will unlike in the past, take research as a life long career and contribute to the advancement of the country in Engineering and other industries.

The Board finds that the resolutions of the Inter Universities Conference is not opposed to the view of this Board. That resolution seeks to include in a 4-year course periods of practical training also. Such practical training had extended in the past over 1 year. The best method in which both the Board's Recommendation and the Resolution of the Inter Universities Conference can be implemented is.---

(a) To reduce the Academic course to 3 years at the end of which the candidates can sit for the B.E.Degree Examination.

(b) To permit the successful candidates to take employment under recognised engineering trades and industries and to award them the B.E.Degree Diploma on the completion of a year's satisfactory training.

Practical course has no where been defined. There is a fundamental difference between a practical course which Engineers can undergo and the apprentice course which Mechanics and artisans should get through.

In the opinion of the Board, the practical course for engineers should aim at giving general training in the method of application of theory to practice, while apprenticeship for mechanics and artisans should give specialised manual training in handling machines and machine tools. It should be evident therefore that Engineers who may have to deal with varying problems in their engineering can only acquire a general training in the art of applying theory to practice in a practical course.

ending extending over only one year. They cannot become specialists with a year's training either in Irrigation or in building construction or in prime movers, or in Power Engineering. It is also the experience of Engineers that no student who is not made responsible for his work and who does not earn a stipend or pay during the practical course really learns anything useful. The so called practical course for Engineers must therefore virtually mean the training that they get in the first year of their employment.

The Board therefore makes the following suggestions---

(1) The Academic course for a B.E. Degree should be over a 3 year period each year with 180 teaching hours as against ¹⁶⁰ ~~180~~ hours at present.

(2) The B.E. Degree examination should be held at the end of the 3 year course.

(3) The B.E. Degree diploma might be awarded to the successful students if they satisfactorily completed a year's employment under a recognised engineering employer. This would meet the requirements of the Inter Universities' Resolution.

The Board requests the Universities in India and the Inter Universities' Conference to consider these suggestions and initiate steps for their implementation.

If you desire further information, the Board will be glad to furnish it on hearing from you.

Yours sincerely,

(N. Govindarajan)

Encls:- Annexure I - List of foreign Universities with 3 year and 4 year engineering courses.
Syllabus for the three years course.

OFFICE OF THE

Date 194 .

Hours Minutes

TELEPHONIC MESSAGE.

From

The S.G.P.

To The Asst. Secy. to Govt.

Ref T.M. by Post No 31443 As/49-A
62005 Edn dt 13.7.49 re Shortening of the duration of engineering course revised syllabus.

Copies of the above will be sent by 20.8.49

13/8

[Please write on both sides.]

and also if convenient
Keep me informed
of the further
steps that may
be taken.

28/102

2

O.F. 304.

2 drafts
10-11
9/9
askin section
D.D. W.E.
6/9/49.

plc.f.

in section.

I

10327

E.P.H.(A)

Letter No. 31443A- & 49A Ed dated 31-8-49.

To
Sri N. Govindaraja Ayyangar, B.A. B.E.
Retired Chief Engineer.
No. 66, Lloyd Road, Royapettah, Madras
(with enclosures)

Sir,
Sub: Reducing the B.E. degree course to
three years - Addressing all cities in India
etc. - Supply of printed copies of draft letter
& revised syllabus for the shortened course
Ref: your letter d. 25/26-4-49 addressed
to the H.M. (Edn.)

I am to send herewith
100 copies of the draft letter to be
addressed to all cities etc. on the
above subject ^{together with} 100 copies of
the revised syllabus of or the
P.T.

104

proposed ^{three year B.F.} ~~shattered~~ degree course
the delay in the supply of the copies is
due to rush work in the Govt. Press.
Yours faithfully,

6/8/49.
1/8/49
31/8/49.

MM
31/8/49

P27cf

Mem. No. 31443A - 5/49A ^{47/15} ²⁹ Date 23/8-49.
Sub: Colleges - Sugg. - Duration of course
Shortening - Printing of revised syllab.
Ref: for on the S.F.P. - T.M. d. 13.8.49.

The printed copies
the matter have been received. The
the original script has not been
returned. The S.F.P. is requested
to return it urgently.

To the S.F.P.
P27cf

Order (Edn) 2845 ^{Edn.} dt. 10.9.49.
MS

6/8/49.
1/8/49
31/8/49.

Abstract. Note The S.F.P. has since returned the original
which is on 13-74 ante. The papers may now
be put away. ~~Records~~
Addressing content. ~~Records~~
Papers needed.

8.9.49. 1/8/49
9/8/49 9/9/49

