Secl(C) II-27—58,004—4-11-46.

E & P.H. **(194 7) Department.**

MS. **SERIES.**

G.O. NO. 2319 Education.

2319

Dated 31st October, 1947.

Close
cc
Recd

[Despatch Abstract.]

University - Annamalai - Engineering courses - Examinations - Poor Results - Papers - Recorded.

Back Papers.

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

Further Papers.

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

Edn. and P.H.Department.
(G-3).

Letter Ref.No. 470539/G2-1 Edn., dated 10/6 -1947.

To

The Registrar,
Annamalai University,
Annamalainagar.

Sir,

Sub:- University - Annamalai - Engineering Courses - Examinations - Poor results.

I am directed to enclose an extract from the Hindu dated 2-6-1947 and to state that the news that 69 % have failed in the B.E (Part I Exam) examination is very disheartening. I am to request that the circumstances which lead to the poor results, may be intimated to Government.

(with copy of A on page 1 c.f.).

All communications should be addressed to the Registrar, Annamalai University, Annamalainagar by designation and not by name.

ANNAMALAI UNIVERSITY

(3)

ASSISTANT SECRETARY TO GOVERNMENT
17 JUN 1947
EDUCATION AND PUBLIC HEALTH DEPARTMENT

No..... 16th June, 194

From

THE REGISTRAR,
ANNAMALAI UNIVERSITY,
ANNAMALAINAGAR.

To

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

Sir,

Sub: University -Annamalai - Engineering courses Examinations- Poor results.

50176 P1 ante

In reply to your letter I am directed to state that the Syndicate has already taken up the matter for consideration.

The large percentage of failures is probably due to the Regulations governing the qualifications prescribed for a pass in the Engineering and Technology examinations here which differ from those obtaining in the Madras University in the following respects. While a special minimum in each paper and an aggregate minimum have been fixed for a pass here, a group minimum for groups of three or four subjects and an aggregate minimum have been prescribed by the Madras University. Suitable amendments to our laws on the pattern of the Madras University standards are under consideration and will be

R

implemented shortly.

I have the honour to be,

Sir,

Your most obedient servant,

Ag.Registrar.

5 (V)

E.& P.H.(G.3)

Letter/Ref.No.470539/42-2 Edn., dated 30-6-1947.

To

The Registrar, Annamalai University, Annamalainagar.

Sir,

Sub:- University - Annamalai - Engineering Courses - Examinations - Poor results.

Ref:- Your letter dated 17.6.1947.

I am directed to enquire for how many years the bye-law referred to in your letter cited above has been in existence and also to request you to furnish details regarding the results in previous years, I am also to add that it is not understood how a mere amendment of the bye-laws will increase the number of passes. I am also to point out that while certain standards may be followed as rules, it is equally necessary that the

efficiency of ~~the~~ an institution should be such that a good percentage of passes should be obtained ~~absolutely~~ on absolute standards, and that passes should not be manipulated by making adjustments.

Particulars about the minimum fixed for passing in the Annamalai University each subject and aggregate are compared with the group minimum and the aggregate fixed in the Madras University.

Y.O.S.,

E.& P.H.(G.3)

Letter/Ref.No.47053-G3/47-3 Edn., dated 12/8/47

To

The Registrar, Annamalai University, Annamalainagar.

Sir,

Sub:- University - Annamalai - Engineering course - Examinations - Poor results.

I am directed to invite a reference to my letter Ref.No.47053-G3/47-2 Edn., dated 30-6-47 and to enquire when a reply may be expected.

Y.O.S.,

Lady Meeta unh

Secretary's note.

All communications should be addressed to the Registrar, Annamalai University, Annamalainagar, by designation and not by name.

ANNAMALAI UNIVERSITY

No. 5651 17.9.47

From

THE REGISTRAR,
ANNAMALAI UNIVERSITY,
ANNAMALAINAGAR

ASST. SECRETARY TO GOVERNMENT
18 SEP 1947
EDUCATIONAL AND PUBLIC HEALTH DEPT.

1st September, 1947.

To

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

Sir,

Ref: No.47053 G3/47-2 Edn.d.30-6-47 --Engineering Examinations Poor results.

The first Regulations were passed in March,1945 to start the courses from July 1945 and these Regulations were subsequently modified in March 1946 on the recommendations of Boards of Studies and Faculties that were constituted later. There were therefore two sets of Regulations in force, one during the academic year 1945-46 and the other during 1946-47.

The first set of rules in 1945-46 provided for sessional marks being included in the examination marks in the various subjects. This provision helped the students to a large extent in securing the indivudal subject minimum and the aggregate minimum prescribed for a pass in the University Examination.

The revised rules in 1946-47 cancelled the above provision governing sessional marks and this accounted for the large number of failures in the subject minimum apart from the absence of group minimum as in the Madras University. A copy of the Regulations (original and revised) are enclosed for information, with the relevant portions marked therein. A statement showing the results of the Examinations of April 1946 and April 1947 is also enclosed. Important variations in the Regulations of the Madras and Annamalai Universities in this behalf are shown in a separate tabular statement attached.

Yours obediently,
Ag.Registrar.

Encl. - 2 sets + 2 Boards

ANNAMALAI UNIVERSITY
ANNAMALAINAGAR

Engineering Examinations.

(1)

Madras.F.E.I.

Group A.

	Examination.	Sessional.
1.Mathematics.	100	...
2.Physics.	100	50
3. Chemistry.	100	50
Total.	300	100 = 400.

Passing Minimum I. No subject minimum, but only a Group minimum of 33% of 400 = 132.

Group B.	Examination.	Sessional.
1.Applied Mechanics.	100	..
2.Civil Engineering.	100	..
3.Geometrical Drawing.	100	50
	300	50 = 350.

Passing Minimum II. 33⅓% of 350= 115⅔.

Aggregate Minimum. III.

Group A. 400
Group B. 350
Total. 750
40% of 750 = 300.

There is provision for exemption from re-appearance in any group if 40% of the group minimum is secured.

Annamalai University.

Intermediate Engineering Part I.

	Examination.	Passing minimum.
1. Mathematics I.	100	30
2. do. II.	100	30
3. Applied Mechanics.	100	30
4. Physics.	100	30
5. Chemistry.	100	30
6. Civil Engineering.	100	30
7. Surveying.	100	30
8. Geometrical Drawing.	100	30
9. Survey Practical.	100	30
10. Workshop Practical.	100	30
Total.	1000	400.

1) No Group system as in Madras
2) No group minimum ,,
3) [illegible] sessional marks ,,
4. Individual subject minimum in 10 subjects: 30% in each
5) Aggregate minimum: 40%

There is provision for exemption from reappearance in individual subjects if not less than 50% is secured.

The scheme of Examination and qualifications for a pass in the examination for the other three years follow on similar lines

---

Annamalai University.

Statement of number of students appeared and passed the Engineering, Technology and Overseer examinations during 1946 and 1947 (April).

	No.appeared.	No. passed.	Percentage.	Percentage failed
1946.				
Intermediate Engineering Part I.	106	92	87	13
Intermediate Technology Part I.	20	18	90	10
Overseer I.	71	61	86	14
1947.				
Inter. Engineering: Part I.	127	96	75.6	24.4
Part II.	92	88	95.6	4.4
Inter. Technology: Part I.	23	17	73.9	27.1
Part II.	17	14	82.4	17.6
Overseer I.	75	73	97.3	2.7
,, II.	61	18	29.5	70.5

14

E 42053

Cutting from 'The Hindu' dated 2.6.47

G3

(9)

1

A

MINISTER FOR EDN. GOVT. OF MADRAS

ASSISTANT SECRETARY TO GOVERNMENT
4 JUN 1947
EDUCATION AND PUBLIC HEALTH DEPARTMENT

ENGINEERING RESULTS IN ANNAMALAI 'VARSITY

Sir,—For B. E. (first year) examination of the Annamalai University, 133 students appeared and only 41 have been declared to have passed, or the failures come to 69 per cent. For B.E. (second year) 89 appeared and only 59 have passed, or about 33 per cent have failed. For the Overseer Examination '72 candidates appeared and 59 have failed or about 76 per cent have failed. In the B.Sc. (Tech.) ten have failed out of 22 that appeared, the failures coming to about 45 per cent.

Such a bad result must inevitably lead one to the conclusion that either the selection of candidates for admission to the courses was very badly done, or that the kind of instruction given in class is poor or that the papers set were above the standard, or that the valuation was very strict. Whatever be the reason, the country and the people suffer. Surely, the authorities must interfere at this stage and set matters right.

A Parent.

GOVERNMENT OF MADRAS
42053
4 JUN 1947
EDUCATION AND PUBLIC HEALTH DEPT.

Secy., E.& P.H.

Please see herewith the news cutting.

The news that 69 % have failed is very disheartening.

The University authorities may be requested to let us know the circumstances which lead to this.

TSA 3.6.47

H.M. Edn.

E+H (G3)

Please see the minutes of H.M.(Edn) above. The Registrar, Annamalai University, may be consulted. A draft letter is subm. for approval.

No typist in Pur. DPI vacn.

H 6/6/47.

P.9.6.47

N 9.6.47 S

Ag (Offg).

E.& P.H.(G.3)

P.1 c.f.

(Issued as letter Ref.No.47053-G/47-1 Edn., dated 10-6-47)

pp3-4 cf

C.No.50176/47 - From the Registrar, Annamalai University, dated 13-6-47

Please see the letter from the Registrar, Annamalai University, on p.p.3-4 c.f.

42

13-6-47

p.p.3-4 c.f. He states that the Syndicate had already taken up the question of low percentage of passes in the recent examinations for the Engineering courses at the Annamalai University. He also states that the low percentage of passes this year is due probably to the Regulations governing the qualifications prescribed for a pass in the Engineering and Technology examinations in the Annamalai University which differ from those in the Madras University in that while a special minimum ~~is prescribed~~ for each paper in the Annamalai University as an aggregate minimum is prescribed ~~whereas only~~ a group minimum and an aggregate minimum have been prescribed ~~in~~ by the Madras University. He also reports that suitable amendments to the laws of the University on the lines of the Madras University standards, are under consideration and will put into effect shortly. ~~For orders as to whether the further report from the Registrar, Annamalai University, on the decision of the Syndicate referred to at A above may be awaited.~~ May be circulated to H.M.(Edn.). It is not clear how far the amendment of the Regulations will result in an increased percentage of passes. What is required is efficient teaching and keeping up of standards besides good discipline.

1A P3 ✓

PP3-4 cf

19/6/47 ar 20/6

2.6.47 S

Then may be confusion if more difference, though by Govt. decision standards & Regulations etc. do not change before 5 yrs.

Ref. material

What the minimum in each subject is should also be enquired. 25.6.47

25.6.47 S

25.6.47 S

25/6

I am not satisfied with the answer of the Registrar of the University. I do not know how merely an amendment of byelaws will increase the number of passes. I would like to know for how many years this byelaw has been in existence and in the previous years in which this byelaw has been in existence what has been the results obtained. Passes should not be adjusted by ~~any~~ adjustment ~~marks~~ percentages. While ~~a~~ certain standards may be maintained, it is also necessary that the general efficiency of the college must be such that a good percentage ~~of~~ passes. The necessary information in this light may be obtained.

PRIMARY, EDN. AND P. H. DEPT. 25 JUN 1947 GOVERNMENT OF MADRAS

TSA 25-6-47

3

(10) EPH(G3)

Please see the minutes of H&H(Edn) on p.2 ante. ~~The letter to the Annamalai University is submitted for approval.~~ The Engineering College is run by the Annamalai University for the last two years only. The bye-law has been in existence in respect of this course for two years only. If the minimum in each subject is not insisted for a pass but only a group minimum, there may be a few more passes. For example a candidate obtaining less than the minimum in a subject may get the group minimum by getting more marks in other subjects which form the group. In the circumstances it is for orders whether the information as indicated in the minute of H&H(EDN) should be called for - If so the draft letter below is drafted.

by

27/6/47

ar 28/6

25.6.47 S

2/6/47

EPH(G3)

PP5-6 cf

[Issued as letter Reg No. 47053 G3/47-2 Edn dt- 30-6-47]

CNo. 7462 5/47. P9 cf

From the Registrar, Annamalai University, No. 56[illegible] dt- 17.9.47.

PP5-6 cf

P9 cf

Please see the minutes of H.M.(Edn.) on p.2 ante. The Registrar, Annamalai University, was consulted on the points raised therein and his reply is at p.p.9-13 c.f. The Engineering courses were started from July 1945. The regulations for them were passed in March 1945. These were subse-

quently modified in March 1946. There were thus two sets of regulations, one ~~for~~ during the year 1945-46 and the other ~~for the~~ during the year 1946-47. Under both the regulations, the students should secure the individual ~~special~~ subject minimum of 30% as well as the aggregate minimum of 40%. The difference between the two is that the first regulations which were in force during 1945-46 provided for the sessional(class) marks being included in the examination marks for the various subjects while this provision was deleted in the subsequent regulations in force during 1946-47. The Registrar states that the deletion of the above provision accounted for the large number of failures in the ~~special~~ subject minimum, apart from the absence of group minimum as in the Madras University. Under the Madras University regulations, the group minimum is 33% and the aggregate minimum is 40%, for the students to secure a pass in the I and II F.E. examinations. Please see the statement on p.11 c.f. regarding the regulations in both the Universities. The statement on p.13 c.f. gives the number of students that appeared and passed in the Engineering ~~examina~~ Technological and Overseer courses of the Annamalai University during 1946 and 1947. It will be seen from it that the percentage of passes in the ~~Annamalai~~ Intermediate/Engineering Part I examination has decreased from 87% in 1946 to only 75.6% in 1947. The percentage of failures given in the press cutting on p.1 ante, is not therefore correct. The number of passes in a particular institution may also depend on the average ability of the students admitted into it, e.g. if a large number of pupils with best records are admitted into it, the result of examinations taken by them may be expected to be better than that of another in which the pupils with less bright records have been admitted. ~~As regards~~ The question of low standard of teaching in the Annamalai University, and other connected matters, have been dealt with separately as it is proposed to send an Inspection Commission to the University. ~~has been taken up separately for consideration~~. The file may now be circulated to H.M.(Edn) with

P9 c.f.

P10 & P11 c.f.

P9 c.f.

P9 c.f.

P11 c.f.

P13 c.f.

A

with reference to his minutes on p.1 ante.

VRS 4/10/47

av 4.10.47

6.x.47

S. 14 (Com)

29 OCT 1947

ISA 29.10.47

EAPA (G3)

Please see the orders in circulation. In view of the proposals in the file referred to at A on p 4 ante, no action seems necessary on this now. ~~It is for orders whether the receipt of the amendments to the laws of the university, mentioned at R on p. 3 c.f. may be awaited till 30/11/47.~~ The papers may be Recorded.

KK

Order/Ms 2319 Edn dt-31.x.47

Abstract:-

University - Annamalai - Engineering Courses - Examinations Poor Results - Papers - Recorded

av 30.10.47

6/11

30.x.47

4546

ANNAMALAI UNIVERSITY

ASST. SECRETARY TO GOVERNMENT
EDUCATION AND PUBLIC HEALTH DEPT.
18 SEP
DEPUTY SECRETARY TO GOVERNMENT
26 MAY 1948
PUBLIC WORKS DEPARTMENT

B. E., B. Sc. (Tech.) and Overseer Diploma



1945

THE
TRICHINOPOLY UNITED PRINTERS, LIMITED,
TRICHINOPOLY
22—9—1945—Copies 250

ANNAMALAI UNIVERSITY

Degree of Bachelor of Engineering: B. E. (Civil Engineering), B. E. (Mechanical Engineering) and B. E. (Electrical Engineering).

1. Candidates for the degree of Bachelor of Engineering (B. E.) shall be required to have passed the Intermediate Examination of this University with Mathematics, Physics and Chemistry as optional subjects or any other examination recognised as equivalent thereto and to have subsequently attended the University College of Engineering for a period of not less than four academic years. They shall be further required to have passed the examinations mentioned below :—

First Year	Intermediate Engineering	Examination		Part I
Second Year ..	do.	do.	do.	Part II
Third Year ..	B. E.	do.	do.	Part I
Fourth Year ..	do.	do.	do.	Part II

2. A candidate appearing for any one of the Engineering Examinations shall produce a certificate of having attended at least 80 per cent of (i) the lectures and (ii) the practical classes.

3. All sessional work is valued and marks awarded by the professorial staff. The list of marks shall be sent by the Dean of the Faculty to the Registrar for communication to the Chairman of the Board of Examiners at least a week prior to the commencement of the written Examinations.

Intermediate Engineering Examination Part I.

4. A Candidate for the Intermediate Engineering Examination Part I shall be required to have attended the University College of Engineering for a period of not less than one academic year and shall be examined in the following subjects :—

1. (*a*) Mathematics ;
   (*b*) Applied Mechanics ;
2. (*a*) Physics ;
   (*b*) Chemistry ;
3. (*a*) Civil Engineering I ;
   (*b*) Surveying ;
   (*c*) Geometrical Drawing.
4. Workshop practice.

The syllabuses for the course shall be prescribed from time to time by the Academic Council on the recommendations of the Board of Studies

5. The scheme of examination shall be as hereunder :

	Subject	Duration of Written paper	Marks
1.	Mathematics	3 hrs.	100
2.	Applied Mechanics	3 hrs.	100
3.	Physics	3 hrs.	100
4.	Chemistry	3 hrs.	100
5.	Civil Engineering I	3 hrs.	100
6.	Surveying	3 hrs.	100
7.	Geometrical Drawing	3 hrs.	100
		Total ..	700

Sessional Work

1. Physics	..	50
2. Chemistry	..	50
3. Surveying	..	50
4. Workshop Practice	..	50
Total ..	..	200

6. Candidates who obtain not less than 30% of the marks in each written paper and not less than 40% of the aggregate marks assigned for the whole examination including sessional work shall be deemed to have passed the Intermediate Engineering Examination in Part I.

Candidates who obtain not less than 30% of the marks in each written paper and not less than 50% of the aggregate marks assigned for the whole examination in all the other three examinations shall be deemed to have passed the respective examinations. All other candidate shall be deemed to have failed in the respective examinations.

Candidates passing in any subject or subjects by obtaining not less than 40% of the marks shall be exempted from reapparance for the Examination in that subject or subjects.

Intermediate Engineering Examination, Part II

7. Candidate for the Intermediate Engineering Examination Part II shall be required to have passed the Intermediate Engineering Examination Part I and thereafter to have attended the University College of Engineering for a period of not less than one academic year. They will be examined in the following subjects :

1. Mathematics ;
2. Applied Mechanics ;
3. Elementary Civil Engineering ;

4. Elementary Mechanical Engineering ;
5. Elementary Electrical Engineering ;
6. Surveying ;
7. Building Drawing ;
8. Machine Drawing ;
9. Workshop Practice ;
10. Surveying and Practical ;
11. Strength of Materials Laboratory ;
12. Electrical Engineering Laboratory ;

The syllabuses for the course shall be prescribed from time to time by the Academic Council on the recommendations of the Board of Studies.

8. The scheme of examination shall be as hereunder :—

	Subject	Duration of written paper	Marks
1.	Mathematics	3 hrs.	100
2.	Applied Mechanics	3 hrs.	100
3.	Elementary Civil Engineering	3 hrs.	100
4.	Elementary Mechanical Engineering	3 hrs.	100
5.	Elementary Electrical Engineering	3 hrs.	100
6.	Surveying	3 hrs.	100
7.	Building Drawing	3 hrs.	100
8.	Machine Drawing	3 hrs.	100
			800

Sessional Work

1. Applied Mechanics ..	..	50
2. Building Drawing ..	..	50
3. Workshop Practice ..	..	50
4. Surveying ..	..	50
5. Strength of Material Lab. ..	..	50
6. Electrical Engineering Lab. ..	..	50
Total ..	..	300

9. Candidates who obtain not less than 30 per eent of the marks in each written paper and not less than 40 per cent of the aggregate marks assigned for the whole examination including Sessional work shall be deemed to have passed the Examination. All other candidates shall be deemed to have failed in the examination.

B. E. Degree Examination—Part I

10. Candidates for the B. E. Degree Examination in Engineering Part I, shall be required to have passed the Intermediate

Engineering Examination in Part II and thereafter to have attended the University College of Engineering for not less than one academic year. They shall be further required to have specialised in one of the branches—Civil, or Mechanical or Electrical Engineering.

11. Candidates in each branch shall be examined in the following subjects prescribed in accordance with the scheme detailed below :—

I. Civil Engineering

	Subject	Duration of written papers	Marks
1.	Mathematics	3 hrs.	100
2.	Strength of Materials	,,	100
3.	Hydraulics	,,	100
4.	Structural Engineering	,,	100
5.	Railway and Highway Engineering	,,	100
6.	Quantity Surveying (Estimating)	,,	100
7.	Geology	2 hrs.	50
8.	Surveying	3 hrs.	100
			750

Sessional Work

1.	Quantity Surveying	
2.	Workshop Practice	50
3.	Strength of Materials Lab.	50
4.	Hydraulic Laboratory	50
5.	Survey	50
6.	Drawing	50
		50
	Total	300

II. Mechanical Engineering

1.	Mathematics	3 hrs.	100
2.	Strength of materials and Theory of structure	,,	100
3.	Hydraulics I.	,,	100
4.	Automobile Engineering	,,	100
5.	Heat Engines I.	,,	100
6.	Electrical Technology I.	,,	100
			600

Sessional Work

	Subject	Duration of written papers	Marks
1.	Strength of Materials Lab.		50
2.	Hydraulic Lab.		50
3.	Electrical Engineering Lab.		50
4.	Mechanical Engineering Lab.		50
5.	Workshop		50
6.	Drawing		50
		Total	300

III. Electrical Engineering

1.	Mathematics	3 hrs.	100
2.	Strength of materials and Theory of structure	,,	100
3.	Hydraulics I.	,,	100
4.	Heat Engines I.	,,	100
5.	Theory and Calculation of Electrical Apparatus I.	,,	100
6.	Design and Drawing	,,	100
		Total	600

Sessional Work

		Marks
1.	Strength of Materials Lab.	50
2.	Hydraulic Lab.	50
3.	Electrical Engineering Lab.	50
4.	Mechanical Engineering Lab.	50
5.	Workshops	50
6.	Drawing	50
	Total	300

12. Candidates who obtain not less than 30 per cent of the marks in each written paper and not less than 50 per cent of the aggregate marks assigned for the whole examination in each Branch including sessional work shall be deemed to have passed the Examination in Part 1 in that branch. All other candidates shall be deemed to have failed in the examination.

B. E. DEGREE EXAMINATION—PART II

13. Candidates for the B. E. Degree Examination Part II, shall be required to have passed the B. E. Degree in Engineering Examination, Part I and thereafter to have attended the University College of Engineering for a period of not less than one academic year and continued their specialised study in the Branch

selected by them for the B. E. Degree Engineering Examination. Part I; provided however, a canditate failing in Part I of the B. E. Degree Examination in Engineering shall be permitted to join the fourth year course in the branch selected and appear for both the parts of the Degree Examination if he had obtained not less than 45 per cent of the marks in any subject or subjects at the Degree Examination Part I. He shall be exempted from appearing for the examination in Part I in that subject or subjects.

14. The candidates in each branch shall be examined in the following subjects in accordance with the scheme detailed below:–

I. Civil Engineering.

	Subject	Duration of written paper	Marks
1.	Strength of materials	3 hrs.	100
2.	Structural Engineering	3 hrs.	100
3.	Hydraulics and hydraulic machinery	3 hrs.	100
4.	Design and Drawing	3 hrs.	100
5.	Sanitary Engineering	3 hrs.	100
6.	Irrigation Docks & harbours	3 hrs.	100
7.	Geodesy	3 hrs.	100
8.	Design and Drawing	3 hrs.	100
			800

Sessional Work

1.	Workshop Practice	.. 50
2.	Strength of Materials Lab.	.. 50
3.	Hydraulic Lab.	.. 50
4.	Estimating	.. 50
5.	Survey and Project	.. 50
6.	Drawing	.. 100
	Total	.. 400

II. Mechanical Engineering

	Subject	Duration of written paper	Marks
1.	Heat Engines II	3 hrs.	100
2.	Electrical Technology II	3 hrs.	100
3.	Theory of machines	3 hrs.	100
4.	Hydraulic machinery	3 hrs.	100
5.	Fuels gas-plant, boilers	3 hrs.	100
6.	Workshop practice & machine tools	3 hrs.	100
7.	Engineering Economics	3 hrs.	100
8.	Design and Drawing	3 hrs.	100
	Total		800

Sessional Work

1.	Mechanical Engineering Lab.	.. 100
2.	Electrical Engineering Lab.	.. 50
3.	Hydraulics Lab.	.. 50
4.	Workshops	.. 100
5.	Design and Drawing	.. 100
	Total	.. 400

III. Electrical Engineering

1.	Heat Engines II	3 hrs.	100	
2.	Electric Theory and measurement	3 hrs.	100	
3	Theory and calculation of Elect. apparatus	3 hrs.	100	
4.	Hydraulics & Hydraulic machinery	3 hrs.	100	Common to Mech. & Elect. branches
5.	Hydro-Electric Engineering	3 hrs.	100	
6.	Generation and Utilisation	3 hrs.	100	
7.	Transmission and Distribution	3 hrs.	100	
8.	Design & Drawing	3 hrs.	100	
			800	

Sessional Work

1.	Electrical Engineering Lab.	.. 150
2.	Mechanical Engineering Lab.	.. 50
3.	Hydraulic Lab.	.. 50
4.	Workshops	.. 50
5.	Design and Drawing	.. 100
		400

15. There will be Practical Examinations in the Final year in the important subjects. Marks allotted for sessional work will be inclusive of the marks awarded at the Practical Examinations to be held from time to time in the course of the fourth year.

16. Candidates who obtain not less than 30 per cent of the marks in each subject and not less than 50 per cent in the aggregate marks assigned for the whole examination including sessional work shall be deemed to have passed the examination in Part II. All other candidates shall be deemed to have failed in the Examination.

17. Successful candidates passing Parts I and II of the Degree Examination in Engineering on the first occasion shall be

ranked in the order of proficiency as determind by the total marks obtained by them in both parts and shall be arranged in two classes, the first class consisting of those securing not less than 60 per cent of the aggregate marks and the second class consisting of all the others. Candidates obtaining not less than 66 per cent of the aggregate marks shall be deemed to have passed the Degree Examination with honours.

Degree of Bachelor of Science (Technology)—B. Sc. (Tech.)

1. Candidates for the Degree of Bachelor of Science in Technology (B. Sc. Tech.) shall be required to have passed the Intermediate Examination of this University with Mathematics, Physics and Chemistry as optional subjects or any other examination recognised as equivalent thereto and to have subsequently attended the University for a period of not less than four academic years. They shall be further required to have passed the examinations mentioned below :—

First year : Intermediate Technology Examination Part I
Second year : do. do. II
Third year : B. Sc. Technology Examination Part I
Fourth year : do. do. II

2. A candidate appearing for any one of the technology examination shall produce a certificate of having attended at least 80% of (1), the lectures and (2) the practical classes.

3. The syllabuses for the four years of the course shall be prescribed from time to time by the Academic Council on the recommendation of the Board of Studies.

4. All sesional work is valued and marks awarded by the professorial staff. Marks allotted for the sessional work will be inclusive of the marks awarded at the practical examination to be held from time to time during the course. The list of marks shall be sent by the Dean of the Faculty to the Registrar for communication to the Chairman of the Board of Examiners at least a week prior to the commencement of the written examinations.

5. Candidates who obtain not less than 30% of the marks in each written paper and not less than 40% of the aggregate marks assigned for the whole examination including sessional work shall be deemed to have passed the Intermediate Technology Examination in Part I.

(17)

Candidates who obtain not less than 30% of the marks in each written paper and not less than 50% of the aggregate marks assigned for the whole examination in all the other three examinations shall be deemed to have passed the respective examinations. All other candidates shall be deemed to have failed in the respective examinations.

Candidates passing in any subject by obtaining not less than 40% of the marks shall be exempted from reappearing for the examination in that subject or subjects.

Intermediate Technology Examination Part I.

6. A candidate for the Intermediate Technology Examination Part I, shall be required to have attended the University for a period of not less than one academic year and shall be examined in the following subjects.

i. French
ii. Chemistry (Organic, General & Physical, & Inorganic)
iii. Mathematics.
iv. General Engineering.
v. Drawing.
vi. Workshop practice.

7. The scheme of examination shall be as hereunder.

Subject	Number of written papers	Duration	Marks
i. French	One paper	2 Hrs.	50
ii. Organic Chemistry	do.	3 Hrs.	100
iii. General & Physical Chem.	do.	do.	100
iv. Inorganic Chem.	do.	do.	100
v. Mathematics	do.	do.	100
vi. General Engineering	do.	do.	100
	Total		550

Practical

Subject	Examination	Sessional work
i. Chemistry	200	100
ii. Drawing	...	50
iii. Workshop practice	...	50
Total	200	200

Intermediate Technology Examination Part II

8. A candidate for the Intermediate Technology Examination Part II shall be required to have passed the Intermediate Technology Examination in Part I and thereafter to have attended the University for a period of not less than one academic year and shall be examined in the following subjects :

i. German
ii. Chemistry (Organic, General, Physical and Inorganic)
iii. Mathematics
iv. General Engineering
v. Drawing
vi. Workshop practice

9. The scheme of examination shall be as hereunder :—

Subject	No. of written papers	Duration	Marks
i. German	one paper	2 Hours	50
ii. Chemistry (Organic)	do.	3 ,,	100
iii. ,, General and Physical)	do.	3 ,,	100
iv. ,, Inorganic	do.	3 ,,	100
v. Mathematics	do.	3 ,,	100
vi. General Engineering	do.	3 ,,	100
vii. Drawing	do.	3 ,,	100
		Total ...	650

Practical

Subject	Examination	Sessional work
i. Chemistry	200	100
ii. Drawing	...	50
iii. Workshop practice	100	50
Total ...	300	200

B. Sc. Technology Part I

10. A candidate for the B. Sc. Degree Technology Examination in Part I shall be required to have passed in the Intermediate Examination technology in Part II and thereafter to have attended the University for a period of not less than one academic year and shall be examined in the following subjects.

i. Chemical Engineering
ii. Chemical Technology
iii. Fuel Technology.

11. The scheme of examination shall be as follows :

Subject	No. of written paper	Duration	Marks
i. Chemical Engineering	2 papers	3 Hrs. each	200
ii. Chemical Technology	2 papers	do.	200
iii. Fuel Technology	1 paper	3.hours	100
		Total ...	500

Practical

Subject	Examination	Sessional
i. Chemistry	200	100
ii. Fuel Technology	100	50
Total	300	150

B. Sc. Technology—Part II

12. A candidate for the B. Sc. Degree Technology Examination in Part II shall be required to have passed in B. Sc. Degree Technology Examination in Part I and thereafter to have attended the University for a period of not less than one academic year and specialised in one of the following subjects or such other subjects as may be included from time to time.

(*a*) Oil Technology
(*b*) Industrial Fermentation
(*c*) Pharmacueticals and fine Chemicals
(*d*) Glass and Ceramics
(*e*) Textile Technology

He shall be examined in the following subjects :—

i. Chemical Engineering
ii. Chemical Technology

iii. Special Subject

iv. Industrial Economics

13. The scheme of examination shall be as follows:—

Subject	No. of written papers.	Duration	Marks
i. Chemical Engineering	2 papers	3 hours each	200
ii. „ Technology	do.	do.	200
iii. Special subject	do.	do.	200
iv. Industrial Economics	1 paper	3 hours	100
		Total	700

Practical Examination.

Subject	Examination	Sessional
i. Chemistry	200	100
ii. Special subject	200	100
Total	400	200

14. Successful candidates passing the Final Examination B. Sc. Technology Part II on the first occasion shall be ranked in the order of proficiency as determined by the total marks obtained by them and shall be arranged in two classes, the first class consisting of those securing not less than 60% of the aggregate marks and the second class consisting of all the others. Candidates obtaining not less than 66% of the aggregate marks shall be deemed to have passed the degree examination with Honours.

Diploma for Road and Minor Irrigation Overseers

1. Candidates for this diploma shall be required to have successfully completed the Madras Secondary School-Leaving Certificate and have been declared eligible for admission to a University course of study or have passed the Matriculation Examination of a recognised University or any other examination accepted by the Syndicate as equivalent thereto and to have subsequently attended the University College of Engineering for a period of not less than two academic years. They shall be required to pass the following examinations.

(*a*) the first examination at the end of the 1st year course; and (*b*) the second and final examination at the end of the second year course.

(19)

2. No candidate shall be permitted to proceed to the second year course unless he has passed the first examination. A candidate who fails in the First Examination may rejoin the college in the first year class if permitted to do so by the University. A candidate who fails in the second and final examination may, if permitted, rejoin the second year class.

3. All sessional work is valued and marks awarded. The list of marks shall be sent by the Dean of the Faculty to the Registrar for communication to the Chairman of the Board of Examiners at least a week prior to the commencement of the written examinations.

4. Candidates for the first examination shall be examined in the following subjects in accordance with the following scheme:

First Examination

Subject	Marks
1. Computation	100
2. Mensuration	100
3. Plane Trigonometry	100
4. Sketching and Machine Drawing	100
5. Geometrical Drawing	100
6. Building Drawing	100
7. Applied Mechanics	100
8. Building Materials and Construction	100
9. Estimating	100
10. Surveying	100
11. Workshops	50
Total ..	1050

Sessional Work

1. Sketching and Machine Drawing	50
2. Geometrical Drawing	50
3. Building Drawing	50
4. Estimating	50
5. Surveying	50
6. Workshops	50
Total ...	300

5. Candidates for the Second Examination shall be examined in the following subjects in accordance with the following scheme :—

Subject.	Marks.
1. Machine Drawing	100
2. Building Drawing	100
3. Applied Mechanics	100
4. Roads and Bridges	100
5. Estimating Roads and Irrigation	100
6. Hydraulic and Irrigation	100
7. Elementary Practical and Mechanical Engineering	100
8. Surveying	100
9. Workshops	50
Total	850

Sessional Work

1. Machine Drawing ..	50
2. Building Drawing ..	50
3. Estimating—Roads and Irrigation ..	50
4. Surveying ..	50
5. Workshops ..	50
	250

6. The syllabuses for the course shall be prescribed from time to time by the Academic Council on the recommendations of the Board of Studies. (For Syllabuses, Vide pp. 46—50).

7. Candidates who obtain at each of the above examinations not less than 45 per cent of the total marks allotted for the written papers and sessional work together shall be deemed to have passed in that examination. All other candidates shall be deemed to have failed in the examination. A diploma shall be issued to each candidate successful at the final examination.

8. Successful candidates in the Final Examination shall be arranged in two classes, the first consisting of those who obtain not less than 60 per cent and the second of those obtaining not less than 45 per cent of the aggregate marks.

SYLLABUSES

(B. E. Degree Examination)

INTERMEDIATE (ENGINEERING) EXAMINATION. PART I.

First Year

Mathematics

i. *Pure Mathematics.*—Algebra—Elementary tests of convergence and divergence of series—binomial, exponential and Logarithmic series—Simple properties of equations.

Co-ordinate Geometry.—The straight line and the circle.

Mensuration.—Plane and solid.

Plane Trigonometry.—De Moivre's theorem.

Expansion of Sin X, cos X and Tan X in powers of X—definition of hyperbolic functions.

Calculus.—Differentiation—Simple application of the derivative to geometry and mechanics; Approximations and small errors; maxima and minima of functions of one variable.

ii. *Applied Mathematics.*—Statics :—Composition and resolution of forces; moments; conditions of equilibrium of forces in one plane, friction, virtual work; centre of gravity—Common catenary; Parabolic catenary; lights string on a rough curve.

iii. *Applied Mechanics.*—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 :—Calculations and graphical determination 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 stresses, Hook's law, stress-strain and load extension curves; dead live and shock loads; factors of safety and working stresses; work and 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 a lap and butt joints; efficiency of joints.

Physics

Heat.—Temperature and its measurements—Thermometer, pyrometers—expansion of solids, liquids and gases. Calorimetry and calorimeters. Vaporisation, evaporation and ebullition—Effect of pressure on the boiling point—Saturated vapours—Critical constants—conduction of heat, convection, radiation, laws of cooling—Laws of Thermo-dynamics—Carnot's Cycle.

Light.—Optical properties and applications of parabolic and cylindrical mirrors, cylindrical and prismatic lenses and totally reflecting prisms. Spherical and chromatic aberration, defects in images due to these and methods of minimising the defects, Dispersion and spectrum analysis.. The study of the sextant, telescope, microscope, range-finders and eye-pieces. (Huyghen, Riamsden, and terrestrial Polarisation with simple applications.)

Magnetism and Electricity.—Magnetic poles ; lines of force ; forces and couples on magnets in the magnectic field. Director of fields due to current in a straight wire and coils. The effect of introducing an iron core in the magnetic circuit. Induced magnetisation. Magnetic properties of iron and steel, Hysterisis. Standard cells ; current. E. M. F. Ohm's law. Electrical units, specific resistance. Measurement of resistances. Conductors in series and parallel. Drop of potential.

Chemistry.

A. Elementary Applied Physical Chemistry :

Gas laws ; Refrigeration and liquifaction of gases—Critical points, Joule-Thomson effect. Principle of counter current systems. Henry's law of partial pressures. Solubility : partition co-efficient—miscible, non-miscible and partly miscible systems. Hess law of heat summation-combustion calculations on fuels. Catalysis with examples on oxidation—hydrogenation—elementary phase rule with reference to alloys under B.—Colloids—sols—gels—reversible and irreversible colloids—their properties.

Elementary treatment of the Electrolytic dissociation theory and its application to electro-plating with detail as regards choise of electrolyte—C. D. and efficiency etc. Ph. values and their importance.

B. Chemistry of Engineering materials :—

1. Water. Sources of impurities- water softening—boiler scale deposits — wet steak — foaming and priming—corrosion prevention.

2. *Fuels and lubricants.*—Types of fuels—solid fuels—(i) Classification—analysis of coal—calorific value—powdered coal—charcoal and coke.

Liquid fuels.—Tar—alcohol—colloidal fuel—fuel oil and their calorific value—Diesel engine fuel—kerosene—gasoline antiknock motor fuel.

Gaseous fuel.—Natural gases—Producer gas –water gas—Blast furnace gas—coke oven gas—coal gas—oil gas.

Principles of combustion.—Ignition temperature—weight and volume relations in combustion—heats of combustion—heat capacities—Heat and material balances.

Petroleum refining.—Products from crude oil—cracking hydrogenation—Blending.

Lubricants.—Description—properties—greases.

3. *Refractories.*–Description of Types of refractories-thermal conductivities and specific heats of refractions.

4. *Non-ferrous metals.*—Aluminium—Copper—Lead—Tin—Zinc—Cadmium—Magnesium—Cobalt—Manganese—Chromium—Tungsten–Molybdenum–Vanadium–Bismuth–Antimoney–Mercury –Titanium.

(Only metallurgy and Engineering properties).

5. *Non-ferrous alloys.*—Phase rule treatment of alloys—alloys of copper—Aluminium alloys—Magnesium alloys—Nickel alloys—Bearing alloys—alloys of soldering and brazing—Low melting alloys.

6. *Iron and Steel.*—Blast furnace—Bessemer and open hearth process. Wrought Iron—Cast Iron and Steel—properties—Metallography.

7. *Alloy Steels.*—With Carbon, Nickel, Chromium, Tungsten, Molybdenum and Vanadium. High speed tools.

8. *Corrosion of Iron.*—Electro-chemical ideas of corrosion—corrosive prevention.

9. *Lime and Gypsum.*—Mortars and plasters.

10. *Cement.*—Properties—setting and hardening—reinforeed concrete.

11. Clay and clay products.

12. Abrasives.

13. Rubber—Natural and artificial—Plastics.

14. Paints—Varnishes—Lacquers.

15. Glues and adhesives.

16. Insulators—Thermal and Electrical.

Text Book.

Chemistry of Engineering Materials by K. B-Leighou MacGraw Hill—1942.

Practical Work.

1. Estimation of hardness of water.
2. Proximate analysis of coal.
3. Ultimate analysis of coal.
4. Calorific value of coal.
5. Calorific value of liquid fuel.
6. Gas calorimeter.
7. Gas Analysis – – G – set.
8. Tests on lubricating oils.
9. Gravimetric analysis of two alloys,
10. Estimation of SO_4 in Gypsum.
11. Estimation of CO_2 in lime stone.
12. Estimation of Quartz in clay.
13. Estimation of CaO, Al_2O_2 and SiO_2 in a sample of cement.
14. Preparation of a sample of steel for microscopic examination and its study with etching solutions.

Civil Engineering. I Year

i. Building materials : Stone, Brick tiles, characteristics, manufacture and uses.

ii. Lime, Cement, Mortars and concretes—Properties, manufacture and uses.

iii. Timbers :–Chief Indian timbers and their characteristics–Causes of decay—seasoning and preservation, strength.

iv. Iron and Steel :—Standard sections and types. Specifications,

v, Paints and Varnishes :—Different kinds.

vi. Miscellaneous materials, other metals—non-metals—glasses and patent materials.

Surveying

Chain survey :—Methods of carryiny out a chain survey—equipment—ranging and chaining line—errors in chaining—Methods of avoiding obstacles—tie lines and check lines—off-sets ; cross-staff and optical square ; the field book ; scale of plan ; methods of booking and plotting.

Compass surveying.—The prismatic compas, constructional details and its uses, Bearing and angles. Magnetic and true meridian—Variation. Declination—Local attraction-elimination of effects—sources o error—limits of precision—adjustment of closing error—methods of booking and plotting.

Plane-table Servey.—Equipment—setting and use of plane-table. Alidades—simple and prismatic—Resection—3 and 2 point problems.

Geometrical Drawing

1. *Practical Plane Geometry :*—Construction and use of scales ; Areas of plane figures, methods of drawing ellipse, parabola, hyperbola, cycloidal and involute curves and helix.

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

INTERMEDIATE (ENGINEERING) EXAMINATION, PART II

Second Year

Mathematics

Pure Mathematics.—Co-ordinate Geometry—Simple properties of the Parabola, Ellipse—and hyperbola in Cartesian Co-ordinates.

Calculus.—Theorem of Mean Value—Curvature–Partia differentiation—Taylor and Maclaurin series. Integration of standard forms—Integral as a limit of a sum—Integration by parts—Reduction of formulae—Areas, lengths of curves, volumes and surface of revolutions—Double and triple integrals—Centre of mass—Moment of inertia—Centre of pressure.

Applied Mathematics.—Dynamics—Composition and resolution of velocities and acceleration—Relative velocity, Newton's laws of motion—Projectiles—Impact—Moment of Inertia—Simple examples.

Hydrostatics.—Transmission of fluid pressure—Thrust of a fluid—on a plane and curved surfaces—Centre of pressure—Conditions of equilibrium and stability of fioating bodies—Mata—centre.

Applied Mechanics.—Beams : Cantilever, simply supported and overhanging beams subject to symmetrical or unsymmetrical static loading and fixed beams only subject to symmetrical static loading—calculation and graphical determination of bending moments and shear forces–relations. between load distribution, shearing force and bending moments. Theory of simple bending—proofs of formulae and their applications. Strength of beams.

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

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

Thin cylinders.—Stresses and strains in thin cylinders subject to uniform internal pressure or both.

Columns and struts.—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.

Distribution of shear stresses in a beam section.

Elementary Civil Engineering

Foundations.—Determination of bearing capacity of coils—excavation, stirring underpinning method of increasing bearing capacity—ordinary foundations such as masonry fohtings grillage and pile foundations and simple calculations pertaining thereto.

Plain masonry and brick work—Common bonds in use and methods of laying; coursed and uncoursed rubble ashlar, coping, cornice and string course; finishing and painting; damp—proof construction; anchorages in walls; fire resisting construction for flues; chimneys and fire place; dressings such as door jambs and door and window sills; flat, segmental pointed and relieving arches—interts centering for arches and striking of centres; vaults and domes.

Floors and roofs; Floor of different materials; terraced and pitched roofs; hack-arched floors and roofs; steal beam and girder floors—simple design calculations timber, miled steel and composite roof trusses; simple design calculations; different types of roof coverings and ceiling and constructional details.

Carpentry and joinary. Usual kinds of joints in timber; doors, windows and ventilators; partitions, scaffolding and false-work; simple roof and bridge frames.

Stairs: Common types of stairs—straigot and spiral in timber, plain masonry, steel and concrete, simple design calculations.

Columns: Details and methods of construction in brick, stone, steel and concrete.

Scaffolding: Materials used and principles of erection and maintenance

Hoisting appliances; Construction and maintenance.

Safety measures—Organization and supervision—safety regulations.

Mechanical Engineering

The boiler: Usual common types; function of the principal parts: Solid, liquid and gaseous fuels suitable for steam raising. Calorific values, cumbustion and draught.

The Steam Engine:—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—principle underlying expansion in stages. Arrangement of cylinders for compound engines. General ideas regarding Meyers, Trip, and Corliss, valve gear. Lubrication, Jacketing of cylinders.

The Steam Turbine: Persons and Delaval steam turbine. Internal cumbustion engines; four-stroke and two-stroke cycle engines; high speed and slow speed. Low compression, high compression and Diesel Engines. Carburetters. Fuel pumps, magnetos; coil ignition, vapourisers, Lubricating and cooling of cylinder. The suction gas engine; sketch, working and names of the principal parts of the gas plant, fuel for the gas plant.

Testing of Engines; Indicators and Indicator diagrams; Indicated H. P. Brake Horse Power; fuel consumption; mechanical and thermal efficiencies; Simple problems.

Transmission of power: Gear drive, belt drive, rope drive and chain drive; velocity ratio. Simple problems.

Manufacturing methods and workshop practice;

General ideas of forging, casting, machining and fitting. Simple illustrations of the complete manufacture of a machine part or engine embodying the above. Elementary ideas of a lathe, shaping, planing and drilling and milling machines and kind of work turned out by each machine.

A brief summary of the materials used in machine conttruction. C. Iron, M. steel, W. Iron, Carbon steel and alloy seels, copper and its alloys, aluminium and its alloys.

Electrical Engineering

1. Electrical circuit : Practical system of electrical units, conductors and insulators. Specific resistance ; temperature coefficient. Series and parallel grouping of resistances Kirehoff's circuit laws and applications.

2. Electro-magnetism ; magnetising force, magnetic induction, permeability. B. H. curve and its determination. Hysteresis and determination of hysteresis laws. Calculations of simple magnetic circuits. Lifting power of electro-magnets.

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

4. Alternative Currents : Production of alternating voltage Wave form, frequency and amplitude. R.M.S. Value, average value. Form factor for sinusoidal alternating currents and voltages. Inductance, reactance and impedance Power and Power factor. Solution of simple series and parallel circuits. Elementary knowledge of three-phase currents.

5. A. C. Machines. Elementary knowledge of the principles and applications of the transformer, alternator, synchronous motor and induction motor.

6. Measuring instruments ; working principles and uses of moving Iron and moving coil ammeters and voltmeters. D. C. Energy Motors 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 wires and three wires D. C. systems A. C. single phase ; three-phase, three wire and four wire systems. House wiring and accessories : testing of faults in house wiring.

Surveying

Levelling : Different types of levels and their construction and details ; use and adjustments of level ; Staves-Fly levels—spot levels, longitudinal and cross sectional levelling, reciprocal levelling. Contouring on land and water. Hill contouring—

Ghat roads—barometric heights—Field books, methods of booking and plotting—allowable errors—clinometers.

Earthwork and capacity of Reservoirs—By contour lines and cross-section levelling.

Building Drawing

1. Detailed drawing of building parts as dealt with in building construction course.

2. Working of small buildings from sketches and specifications together with simple design calculations.

Machine Drawing

1. Copying accurately to scale drawings of simple machine—details such as bolts, nuts, keys, cotters, rivets, and riveted joints, pipes and pipe joints, bearings, hangers, pedestals, wall fixings, etc.

2. Drawings of simple machine and engine parts from sketches. Ability to supply additional views and to give some idea of the proportions of simple machine parts.

B. E. ENGINEERING EXAMINATION

Part I

Syllabus for Third Year Courses for Civil, Mechanical and Electrical Branches

Mathematics

(Common to Civil, Mechanical and Electrical)

Calculus—Differential equations of the first Order and the First Degree—Line differential equations with constant co-efficients.

Fourier's series—Elements of harmonic analysis.

Applied Mathematics—Dynamics—Moment of inertia—Product of inertia—Principal axes of inertia—motion in a circle. Harmonic motion—Simple pendulum—Kinetic energy of a body rotating about a fixed axis. Compound pendulum—instantaneous centre—Equations of a motion of a rigid body in a plane.

Hydrostatics—Pressure of the atmosphere—Boyle's law—simple hydrostatic machines—Work done by the expansion of gas.

Strength of Materials and Theory of Structurers I

(Common to Civil, Mechanical and Electrical.)

Compound stresses and strains—Stresses under combine, strains, principal stresses and principal planes; ellipse of stress; Moliss diagram. Application to different cases.

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

Circular Shaft. Theory of pure torsion, shear, stress, angle twist, strength and resilence; horse-power transmission combined torsion and bending with or without end thrust; determination on principal stresses and maximum shear stresses; equivalent bending moments and equivalent twisting moments.

Helical Springs—Extension under axial pull and maximum shear stress angle of twist and torsion and maximum direct stress, strength and resilence

Thick shells and Cylinders—Stresses under internal and external pressures.

Deflection of frames, Catigliano's Theorem I. Resilence due to bending moment, shear and torsion.

Continuous beams and propped cantilevers—Theorem of threee moments calculation and graphical determination of reactions, bending moments, shear force, deflection and slope —Moment distribution methods.

Masonry Works. General conditions in stability—Middle third rule—lines of resistance—distribution of pressure intensities elementary principles of design of masonry dams, gravity section.

Hydraulics I. (Civil, Mechanical and Electrical)

Fluids in motion.—ideal fluid—steady and unsteady motion—stream line—Bernoulli's theorem—applications—venturi meter—vortex motion.

Orifices and notches—small orifices—large orifices—drowned and partially drowned orifices—mouth pieces—

time of discharge—weir; rectangular, triangular, trapezoidal, velocity of approach: drowned weirs, height of sill-nappe and its stability—flat crested weirs—Gauging weirs—weirs and anicuts—bridge openings—sluices.

Pipes—Loss of head and hydraulic gradient—straight and circular pipes of uniform diameter and hydraulic mean depth. Empirical formulae, Chezy: D'Arcy, Kuttur and Logarithmic—bends—elbows—valves—variation of velocity in cross section variable diameter—syphons, hammer action.

Structural Engineering I. (Civil, Mechanical and Electrical)

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

Masonry—Retaining walls and dams, 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 constructions; detailed design of gravity and panelled retaining walls and gravity and arched masonry dams.

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 abutments; detailed design of arched bridges and culverts for specifications and empirical rule.

Reinforced Concrete—General principles; Theory and design of rectangular beams; the-beams, slabs and columns; arrangements of laying reinforcement; leading system of reinforcement; economical methods of construction design and details of form-work.

Structural Steel Work. Beams and Girders: Properties of British Standard sections; detailed design of beam; compound girders, built-up plate girders and lattice girders—girder types and typical details of construction.

Columns and Struts.—Plain and built-up sections; assumptions regarding end conditions; practical formulae for design; design and details of caps, bases and brackets for stanchions: lacing on stanchions.

Roof strusses.—Roof strusses; detailed design of members including purlins joints and connections.

Geology. *(Civil)*

Petrography: Igneous, sedimentary and metamorphic rocks—classification of igneous rocks. Sedimentary rocks and more important metamorphics.

Structural Geology. Stratification, dip, strike, outcrop folds, faults, etc.

Civil Engineering Geology. Building stones and materials underground water circulation and artesian wells. Abrasives—asbestos, chalk clays—refractories.

Railway and Highway Engineering. *(Civil)*

Railway Engineering.—Permanent way; gauges Indian railways; plate laying and maintenance—points and crosssings—Details and formulae and practical rules—superelevation creep of rails, ruling gradient—compensation—track resistance, tractive effort—important stations. station yards—general knowledge about signalling and interlocking.

Tunnels and their alignment and methods of construction.

Highway Engineering.—Classification of roads—estimation traffic—availability of materials and choice of type of roads—tests of materials—gradient camber: road foundation nad under drainage—road surfaces—water bound macadam—tar sprayed macadam—tar macadam—hot and cold emulsions—bitunminous carpets stone paving, wood-block paving—asphalt roads—plain and re-inforced concrete roads-standard specifications; resistance to motion of vehicles and influence of various road surfaces—estimation of draft—machinery employed—latest advances in highway engineering.

Surveying. *(Civil)*

Surveying.—Advanced and precise levelling-contours-grade-contours—stadia ond their use. Sources of error; precautions, accuracy, required; correction for curvature and refraction; dip of the horizon.

Tachometry.—strdia. Triangulation-Base line measurement-accuracy corrections required-field observations—atellite stations—3 point problem.

The theodolite: types of instrument; parts of the instruments and their uses. Handling and care of instruments; temporary and permanent adjustment.

Traverse surveying.—Gale's traverse system. Errors; degree of accuracy and checking work; principle of method of least squares.

Laying out curves with and without theodolites; determination of heights. Use of planimeters; finding areas by various methods—use of instruments such as sextants, barometers etc.

Heat Engines—1.
(Common to Mechanical and Electrical)

Thermodynamical principles—laws of perfect gases—Entropy diagrams—hot air engines—cycles of operation—Carnot's cycles—conditions for maximum efficiency—internal combustion engine—gas and oil engines—constant pressure-constant volume cycles—effects of compression—ndicator diagrams-efficiencies—engine testing.

Air Compressors.—Theory of air compressors and motors—single and multi-stage compressors—efficiency.

Mechanical refrigeration.— Properties of vapour ammonia, carbon-dioxide—sulphur dioxide-choice of a referigerating agent—Co-efficient of performance—types of vapour compression machines—horse-power required—design and erection of cold storage rooms and refrigerating plants.

Electrical Technology—1.
(Mechanical)

General principles.—Electric and magnetic laws, units and Standards. Electric and magnetic properties of materials—electric and magnetic circuits. Magnetic Measurements of permeability aud hysteresis.

Measurements.—The principles and construtctions, 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 types: construction working aud simple theory—types of windings; lap and wave. E. M. F. equation. Armature reaction—tests by direct and

indirect methods. Parallel operation and sharing of loads between generators—The third brush and Resenberg generators.

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

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

Alternating currents.—Elementary theory of single and polyphase currents.

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

Electrical

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. Tirril regulator. , Rosenberk, three-brush and arc-welding generators. Balancers and boosters.

D. C. Motors.—Calculation of torque. Back E. M. F. induced in motor armature. Load characteristics of shunt, series and compound motors. Swinburne's tests. Testing pairs of similar series and shunt motors.

Acid and Alkaline Batteries.—Installation and first charge. Charging equipment. Miling, 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 constructions. 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-transformer; comparison with double wound transformers. Instrument transformers.

Polyphase currents and circuits.

Polyphase transformers.—Types and construction. Three phase connections. Third harmonic in phase voltage. Tertiary winding. Auto-transformer. Transformation from three phase to single phase, two phase, six phase and twelve phase. Paralleling and parallel operation. No-load and on-load tap changing, Induction and moving coil voltage regulators.

Design and Drawing I *(Electrical)*

D. C. Machines. Magnetic and specific electric loading. Output coefficient. Effect of number of poles on general design. Ration 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-cap. Field windings. Inter-poles—Commutator—Brushes. Armature reaction. Regulation and series winding. Calculation of the open-circuit characteristic

Transformers.—Output—specific loadings. Design of coresection and number of turns. Coils and insulation. Reinforced coils. Magnetising current. Cooling. Losses. Calculation of efficiency and regulation.

B. E. ENGINEERING

Part II

Fourth Year (Civil)

Strength of Materials and Theory of Structure II

Theories of earth pressures - geographical constructions —retaining walls—Rankine's theory applied to foundations.

Moving loads and influence lines.

Curve of maximum bending moments and maximum sheer 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 spandril-braced arches; reversal of stress under live load.

Suspension bridges and Arches—Stresses in loaded cables and hanging chains; stiffening girders; moments and shears in such girders; elastic theory of the regid 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 locil; lines of resistance through rigid and hinged arches under dead and live—loading.

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

Structural Engineering II

Reinforced Concrete-bridges.—Detailed design of different types of highway bridges.

Tanks and towers.-General principles of design; methods and details of construction, detailed design of low and high tanks from specification. Recent advances in reinforced concrete construction and in methods of calculation vibrated concrete. Prestrenny—mechanical methods of stress analysis. Column analogy methods.

Retaining walls.—Cantilever and Counterfort types; their detailed design from specifications, methods and details of construction.

Miscellaneous structures.—General principles relating to the design and construction of bunkers, gantries, domes, jetties, pile and raft foundations steel work—Bridge work. Detailed design of highway and railway bridges of plate and la ttice girder types. Different types of floors, transverse and lateral braces and bearings; important considerations and general principles relating to design of cantilever, suspension, swing, lift and bascule bridges.

Miscellaneous Structures.—General principles relating to the design of tanks and towers, structural parts of cranes, tall chimneys bunkers, domes, jetties, pipe lines etc.

Timber.—General principles of design in timber with special reference to structures, such as roof trusses, beams and columns, bridges, trestles and form-work for reinforced concrete structures.

Erection.—General methods of erection of building and bridges.

Hydraulic and Hydraulic Machinery II (Civil)

Channels.—Variety of forms – steady motion in uniform channels; Formulae D'Arcy. Bazin, Jutter, Logarithmic; variation of velocity in cross section—measurement of discharges—sections of aqueducts and sewers—best form of channels—non-uniform flow—backwater.

Measurement of flows, discharges.—Pipes, meters-Pitot tube-chemical method-channels weirs formulæ, floats-Ripple method-Gauges-current meters.

Impact.-Pressure on fixed and movable vans-Work done

Water Wheels.—Turbines; Piston engines.

Pumps.—Reciprocating, centrifugal-Hand-Ram-Airlift, etc.

Sanitary Engineering—Water Supply (Civil)

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, quantity.

Rivers.—Trenches, infiltration gallery.

Storage reservoirs.—Site, capacity, compensation water dams, waste weirs, outlet, conduits, valve tower

Conveyance.—Pipe lines, hydraulic gradient, types of aqueducts, syphons, air valves, balancing reservoirs.

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

Pipes and Pumping—Pumps and suitability, pumping station.

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

Slow filtration.—Filter beds: area, size arrangement of sand-layers, materials and construction, rate of flow, regulation cleaning.

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

Sterilization. By chlorine, light electricity, etc.

Softening.—Hardness in water, method 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 detection and prevention. Meters.

Sanitary Engineering Contd.

Sewerage and sewage disposal.

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

Trade Effluents.—Their treatment.

Drainage and Sewerage.—Rainfall, house drains, surface drains, under ground 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 ventillation storm overflows, out fall into sea.

Sewage disposal—Composition of sewage. Disposal on land, sewage sludge utilisation as manure, disposal in the sea.

Bacterial purification.—Contract beds, intermittent sand filtration, precipitation, septic tanks trickling filters, sludge disposal of sludges, activated sludge, design of disposal works.

Public Utilities.

(Water works, sewerage and sewage disposal.)

Hospitals, libraries, fire stations, schools, markets, burial and burning grounds, slaughter houses, public baths, parks and playgrounds, theatres and cinema halls etc.

IRRIGATION, DOCKS, AND HARBOURS.

Irrigation Engineering

General.—Importance of irrigation works ; productive and protective works—general principles of flow, life perennial, basin or inundation and well irrigation ; principal crops, duty, factors, affecting duty for crops under storage and direct flow irrigation, duty in Madras systems. Rainfall and Run-off ; study of rainfall statistics utility in run-off calculations, flood discharge and its estimation. Percolation, evaporation and absorption looses in canal and storage systems, Uplift a piping ; stability of work 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 on permeable and impermeable soils weir crest shutters ; principles governing the design and construction of river regulators, undersluices, flood banks, and protective works. Retrogression of levels.

Storage works.—Selection of site ; masonry dams ; principles of—design of gravity, arch and other types ; uplift in masonry dams ; drainage galleries ; expansion joints ; methods of construction. Earthern dams ; causes of failures ; types of dams ; materials for dams, methods of construction, drainage of earthern dams ; and foundations. Component works—sluices surplus escapes ; ordinary types, stepped waste weirs, syphon spillways. Selection of sites—tanks—isolated and rainfed, single or in groups, supply, capacity, repairs to bunds and breaches. Flood absorptive capacity of reservoirs ; formulae for design of weirs.

Distribution systems.—Design and alignment of canals, distributories etc. In delatic and non-delatic countries—capacity command, limiting velocity etc. Drainage, necessity water logging, alkalinity of soils, drainage, principles in design of drainage channels ; outfalls, lining of canals. General description, construction and design of masonry works of canals (*a*) for regulation of water levels ; rapids, falls or drops, notches, escapes, syphon well drops, sluices ; (*b*) cross drainage works and surplus works, aqueducts, syphon aquaducts, super passages, level crossings, inlets and outlets ; (*c*) communication works, road dams, fords etc.

Navigation canals.—Main features ; locks, desirability of combining navigation and irrigation.

River training works.—Spurs, groynes, Bells bunds mattresses, sprons etc.

IRRIGATION, DOCKS AND HARBOURS

(Docks and Harbour Engineering)

Physical geography in relation to docks and harbours; natural phenomena, prevalence and intensity of winds, coastal changes; accretion and denudation; effect of artificial interference; tidal phenomena: waves form; height and length wave velocity and wave action.

Objects of docks and harbours; consideration effecting choice of site: entrance to docks and harbours, fore-shore protection and channel regulation: wet, dry and floating docks; tidal basins and harbour, different forms and types; detail and methods of construction, lock gates; their construction and working, machinery employed. Different types of quay walls, their construction and maintenance; signals and light houses, ferries and landing piers, description of important existing docks and harbours. Latest advancement in dock and harbour engineering.

Drawing and Design 1—(*Civil*)

Designing and detailing important types of buildings, bridges and culvert in plain masonry or timber.

Designing and detailing steel work for steel-framed buildings plate and lattice girder bridges (road or railway) tanks and towers

Designing and detailing reinforced concrete buildings highway bridges, retaining walls, tanks and towers.

Surveying (*Civil*)

Tunnel surveying—mine surveying—instruments and method of using them.

Hydrographical surveying—Tides and tide guages—sounding—shoreline surveys.

Photo-theodolite—photographic surveying-geodetic and astronomical surveying.—spherical trigonometry—and simple formulae—astronomical terms and explanations—altitude—azimuth—right ascension—declination—hour angle siderial and mean time—meridian latitude—longitude observations for their determination.

Latest instruments.

Nautical almanac.

Heat Engines II (Mechanical and Etectrical)

Properties of steam, wet, dry and superheated—Total heat external work done—internal energy—entropy of steam—related diagrams.

Steam Engines.—Expansive working of steam-Rankine's cycle—efficiency-losses in actual engine due to wire-drawing-steam jacketing—methods of reducing losses-advantages of compounding and multiple expansion. Indicator card and diagram factor—engine trials.

Turbines.—Flow of steam through nozzle—velocity at throat and exit of nozzle—nozzle design—effect of friction—supersatuated flow—impulse turbine—velocity diagrams—blade friction—compounding of impulse turbines—velocity compounded and pressure compounded turbines—reaction turbines—Parson's Junestron and other types—Velocity diagrams—Design of blades and drums—factors affection efficiency.

Machine details.—Cylinders, pistons, valver, piston rods, stuffing box glade and packing, connecting rods, crosshead and guides. Crankshaft bearings and bed plate. Governors. Condensers and pumps. Lubrication and jacketing of cylinders.

Valves and valve gears.—For Stationary and locomotive steam engines; D. Side valve; Meyer's expansion valve; link motions and radial gears. Corliss valves; drop valves and trip gears; valves for internal combustion engines, air compressors and refrigerating machines; diagrams and flywheel calculations.

Electrical Technology II (Mechanical)

A. C. Generators.—Singil and polyphase; construction, working and simple theory. Tests of efficiency and regulation by direct and indirect methods.

A. C. Motors.—Synchronous motor, construction working and simple theory; current locus at constant voltage excitation variation of current and power factor with changing excitation; hunting and drevention. Polophase induction motors squirrel case and slip ring types; simple theory, working a construction; rotating field direct and indirect tests on formance; the circle diagram; methods of starting. Simple theory and operating features of the single phase induction motors, series motors and chrage motors.

Synchronous convertor : Simple theory and operating feature.

Measurements.—The principle of construction, use and calibration of A. C. instruments ordinarily employed. The Duddell Oscillograph. The synchroscope. Single phase power factometer.

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

Theory of Machines
(Mechanical)

Kinematics and pure mechanism.—Definition of a machine, machine elements, links, chains and mechanisms.

Constrained motion.—Translation and rotation ; instantaneous centres ; velocity and acceleration diagrams, inversion of mechanisms. Quick return motion, cylinder crank chain.

Transmission of power.—Wheel trains, simple, compound and epicyclic, Chain belt and rope drives.

Friction of rest and motion.—Screw threads, thrust bearing, clutches and brakes, work gear and cams. Properties of lubricants—types of lubricants—tests—types of lubricators.

Reciprocating Engine.—Velocity and accleration of piston and connecting rod, mertia effects, turning moment diagram, flywheel. Balancing of Engines, primary and secondary effects, Governers.

Gyrostatic action—torsional oscillations—vibrations, forced, viscous ; damping.

Hydraulics and Hydraulic machinery—II
(Mechanical)

Water wheels and turbines.—The action of a jet upon vanes, whether at rest or in motion ; straight or curved—waterwheels—theory design and efficiency—turbines—theory design and speed regulation—general features of a hydro electric plant.

Pumps.—Bucket and plunger ; pistons valves ; air vesseles and stand pipes ; efficiency of pumps. Centrifuga, and turbine pumps, multi-stage pumps—pulsometer—ramls air-lift pumps ; gas pump etc.

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

FUELS, GAS PLANTS AND BOILERS
(Mechanical)

Fuels.—Types—physical characteristics—approximate chemical composition—calorific value—variation of coal—coke—distillation of coal, pulverised fuel—liquid fuels—fuel burners—fuel consumption—varieties of gascous fuel—standard laboratory tests.

Gas Plants.—Gas producers ; pressure and suction plants arrangement and working.

Boilers.—Description and working of the common types-boiler fittings—boiler accessories—mechanical stokers—feed water and its treatment—natural forced induced and mixed draught ; heating surface fire-grate area—efficiency of the boiler—related problems—boiler trails—heat balance sheet—boiler room—inspection and maintenance of boilers—tests—brief description of short processes and use of special tools involved in the construction of a boiler. Board of Trade and Lloyds specifications.

Machine tools and Workshop Practice
(Mechanical)

Smithy —General shop lay out—equipment, tools, and processes, illustrative example—Power hammers—examples of heavy forging —general ideas on mass production.

Foundry.—General lay-out equipment and tools—pattern making — moulding sand — types of moulding — machine moulding—illustrative examples—making cores and core-boxes—Blowers—Cupolas—methods of charging and casting —nonferrous melting practice—Die casting—Mass production and accessories therefor.

Fitting Shop.—Equipment-Tools and their maintenance —Bench work—Illustrative examples.

Machine Shop.—Specifications, descriptions of parts construction and working of the following machines :—

Lathe—shaping, planing, slotting, drilling, milling, boring, and grinding machines—gear cutting machines—modern improvments to the above machines—types of work—design of tools and cutters—speed and feed—reconditioning of machines—standard alignment tests—general ideas on jigs

and fixtures—tool room practice—heat treatment—electric and other furnaces—baths, tools and cutter grinding.

Mesurements.—Mesuring instruments — micrometers—vernier, calipers, gauges—classes of fits—limits and limit gauges—tolerance and allowance—optical methods.

Metallurgy.— Composition and heat treatments of the more important metals—and alloys—hardening, tampering, case hardening—nitriding, annealing and normalizing.

Machine Drawing and Design.
(Mechanical.)

Machine designs—Preparation of detailed working drawings of machinary and plant from given specification and from students' own design.

Engineering Economics.–Business organization, advertising insurance, stores, costs and costing, depreciation, and valuation. Labour and wages, methods of paying wages, bonus and profit sharing systems. Trade Unions, Strikes and Lockouts.

Book-keeping.—The Journal, cash book, purchases book, sales book, the ledger, double entry, balancing, trail balance, balance sheet, bad debts. The trading and profit and loos accounts.

Specifications.—Specifications for inviting tenders. Information to be given an priliminary enquiry and on placing the orders, contracts for supply, erecting, guarantees and acceptance. Standard forms of contracts.

Law—Industrial legislation. Workman's Compensation Act. Prevention and settlement of disputes—Unemployment Insurance—Health Insurance.

ELECTRICAL ENGINEERING. PART II.
(Fourth Year.)

Electrical Theory and Mesurements.

Electrical Units and standards.—Relation between C. G. S. and the practical electrostatic and electromagnetic units. Standard cells. Standards of luminons flux, candle power and illumination. Self and mutual inductance. Capacitance, self and external.

Alternating Current Theory.—Symbolic vector methods and 'complex' quantities and their application to practical cases *i. e.* Polyphas circuits and alternating current net works,

Inversion and application to simple circuits. Harmonics in single and Polyphase circuits Properties of rotating fields. Simple cases of transcient 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 Wheat stone, the Carey, Foster and the Kelvin bridge. Measurement of high and low resistance and reactance; the Schering bridge and Heaviside Camp be bridge. Frequency mesurement. Oscilographs for high and low frequencies, Measurement of magnetics properties of iron. Iron loss mesurement and Watt meter. Epstein tester. Measurement of dielectric properties. Measurement of luminous fluxcandle power, illumination. High voltage testing.

Elecrical Measuring Instruments.—Moving coil, moving iron, elctrostatic, thermal, dynamo-Meter and induction types. Energy meters. Ohm meters Meggar Frequency meters. Power Factor Meter. Reactive current ammeter and synchroscope. Maximum demand indicator. Electrical pyrometers.

Theory and calculation of Electrical Apparatus II.

Alternator.—Types and construction. Methods of producing sinusoidal voltage. Single and polyphase armature windings Expression for induced voltage. Star and delta connections. 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. Synchronising and synchronoscopes. Synchronising torque. Parallel operation.

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

Single Phase Commutator Motors.—Theory of operation. construction, vector diagrams and characteristics of

uncompensated and compensated series motors Shunt and series commutating poles. Methods of starting. Comparison of A. C. and D. C. series motors. Theory of operation, construction and characteristics of repulsion motors.

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. Predetermination of performance. Induction generator. 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. Polyphase capacitor motor and charge motor.

Single Phase Induction Motors—Resolution of single phase flux into two rotating fluxes. Operation. Theory of operation, characteristics and starting of polyphase induction motor on single phase. Theory of operation and characteristics of split phase, capacitor and repulsion—start induction motors and repulsion—induction motor

Rotary Converters.—Synchronous converter. Theory of operation. Voltage and current ratios. Wabe form of current in various coils. Armature copper loss efficiency. Theory of operation, starting and characteristics of motor-converter. Power transformed mechanically and electrically.

Rectifiers.—Mercury arc rectifier—Theory of operation. Transformer connections. Characteristics. Interphase transformer. 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.

HYDRO-ELECTRIC ENGINEERING

Preliminary investigation and report.—Possibilities of economic development—possibilities of load.

Rainfall.—Evaporation from water and land surfaces—Run off—seepage—Estimation of steam flow—Gauging. sounding and meter observation. Flood flows. Available power without storage. Storage and pondage. Storage diagrams. Mass duration and time curves—Flow over dams and rivers. Discharge through sluice gates Eddy losses and loss of head. Water hammering.

Choice of site—available head—Market requirements. Possible flow regulation. Alternative schemes of devoelopment.

Dams.—Types and descriptions—stability calculations. Spillways—expansion joints—Rolling gates—Drainage gates. Intakes, headgates and valves. Canals, flumes, tunnels, conduits, pipe lines, air valves relief valves, and surge tanks.

General layout and design of power stations. Turbines—general types, application and constructional details. Characteristic curves. Specific speeds and speed regulation, Choice of turbines. Temperature detectors. Fire protection—Station wiring and lighting—auxiliary power plant—Switchgear layout.

Economics of hydro-electric development—Limiting capital cost of H. E. plant—operating expenses—Cost of Hydro-electric installation. Inter connection of steam and hydroplants—stand-by service.

Generation and Utilisation

Generation.—Fixed costs and working costs of generation. Straight line and sinking fund methods of depreciation. Maximum demand, load factor, diversity factor, and their influence on the cost of generation. System s of tariffs. Choice of site of station. Choice of prime movers and number and size of units. Combined steam and hydroplants. Inter-connection stations.

Cooling systems for generators. Protection against fire. Objects and methods of earthing the neutral. Protection relays. Excitation systems. Voltage control. Switchgear. Short circuiting of generators. Current limiting reactors.

Utilization

Electric Drive.—Comparison of electrical and mechanical drives. Individual, group and semi-group drives. Cause 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.

Electric Transaction. Direct current. Single-phase and three-phase system. Motor characteristics. Sub-stations. Line and track construction. Current collection. Manual and automatic controllers. Locomotive motor coach and multiple

unit trains. Diesel electric transaction. Mechanics of train movement. Energy and speed-time calculations.

Illumination.—Filament and gaseous discharge lamps and their characteristic. Shades and reflectors. Design of factory lighting and interior illumination of buildings. Parallel and series systems of street lighting.

Transmission and Distribution

Transmission system—Electrical and mechanical properties of conductors. Corons. Construction of high voltage under ground cables. Potential stress. Losses and faults in cables. Types and construction of 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 protective relays. Lighting arrestors; Transposition of lines.

Loading and strength of conductors.—Sages and stress in conductors with supports at same level. Effect of temperature variation. Sags and stress in conductors with support at different levels. The Thomas Chart and its use for sag and stress determination. Use of wooden poles, steel poles, steel towers.

Comparison of D. C. two-wire and three-wire, A. C. single phase, system of distribution. Primary and Secondary distribution. Calculation of voltage drop, in conductors for concentrated and distributed loads.

Design and Drawing—II

Alternators—Low speed, medium speed and Turbo-alternators. Output coefficient. Main dimensions. Stator winding. Design of slot Design of field system. Essential features in the construction of the Stators and Rotors.

Induction Motor.—Calculation of the dimensions. Stator winding. Rotor slip-ring and squirrel cage, Magnetising current. Efficiency.

B. Sc. (TECH.) DEGREE SYLLABUSES

1. *Scientific German*—The examination will be a test of the capacity of the candidate to translate freely from German Scientific literature into English.

2. *Chemical Technology (I)*—Manufacture of heavy chemicals, acids, alkalis, industrially important salts, Fertilisers, ceramics, glass, cement, Metallurgy—steels and non-ferrous alloys.

3. *Chemical Technology (II)*—(*a*) Organic unit processes—nitration, sulphoration, oxidation, reduction, alkali fusion.

(*b*) Organic Chemical Technology—Petroleum dry distillation of coal, wood etc. Sugar industrial fermendation, alkaloids—Textile cellulose paper, oils, fats, soaps, waxes, proteins, essential oils, plastics, paints, varnishes, tanning, dyes, drugs, explosives, industrial solvents.

4. *Oil Technology*—Occurrance of and methods of preparation of animal and vegetable oils. Chemical constitution of oils. Preparation of fatty acids, glycerine; hardening of oils, Soaps, fish oils—Oils for use in paints, varnishes—Limoleum industry—Drying and semi-drying oils. De Odourising, decolorising oils, purification of oils.

5. *Fuel Technology*—Industrial chemistry of commercial fuels. Solid fuels. Distillation of coal Assay of coal. Liquid fuels. Petroleum. Hydrogenation of coal Power alcohol. Tests for liquid fuels. Gaseous fuels. Natural gas. Industrial gases. Producer gases. Gas producers. Technical gas analysis. Heat valve of fuels.

6. * *Applied Mathematics*—(*a*) *Calculus*:–Differentiation and its uses. Differentiation of algebraic, trignometrical, logarithmic and exponential functions.

(*b*) Differential equations.

(*c*) Principles of logarithms—Slide rule. Application of these in chemical calculations.

7. *General Engineering*—Properties of materials and machines. Physical and chemical properties of materials. Stresses.

Heat engines. Properties of steam and modern steam generators. Internal combustion engines. Air compressors.

Power gas. Producer gas. Water gas. Gas analysis. Power transmissions—Distribution of steam, power gas and compressed air.

Electrical. Power generation. Types of generators, transformers and motors. Cables, switch-board, fuses, accumulators.

---

* The revision of the syllabus is under considiration.

8. Chemical Engineering I.

(*a*) *Thermodynamics.*—Fundamental concepts in chemical systems. Internal energy, heat content, heat of reactions, thermo-chemistry, direction of chemical change.

(*b*) Velocity and mechanism of reactions, Catalysis—Theory and application.

(*c*) Applications of electro-chemistry.

(*d*) Applications of phase rule. Binary, ternary and higher mixtures.

(*e*) Technical applications of colloid chemistry.

(*f*) Technical applications of photo-chemistry.

9. Chemical Engineering II.

(*a*) *Transference of heat.*—Refrigeration, heat exchangers, coolers, heaters.

(*b*) *Separation of materials.*—Extraction, evaporation, distillations, filtration, drying, crystallisation, absorption, adsorption.

(*c*) *Reaction treatment.*—Roasting, calcimation, destructive distillation, electrolysis, catalysis hydrolysis, fermentation.

(*d*) *Organic unit processes.*—Nitration, reduction, oxidation, sulphoration, diazolisation.

(*e*) Furnaces and kilns.

(*f*) Processes. Crushing, grinding mixing.

(*g*) Materials of construction—metals, steels and non-ferrous alloys—non-metals.

10. *Industrial Economics and organisation.*—Factory management, labour, location of plants, economic generation, transporation, raw materials, costing, accounting, safety rules.

11. *Drawing.*—The use of drawing instruments; printing; conventional signs in mechanical and chemical engineering—inking—bolts, nuts, rivets, pipe joints, ball and socket. Copying to scale—machinery and chemical engineering rivets.

12. *Practical work.*—A. *Chemical laboratory.*

(*a*) Analysis—water, ores, alloys, fertilizers, lubricants, oils, fats, soaps, paints, varnishes, sugar, starch, dyes, cellulose.

(*b*) Preparation. Study of reactions, preparation of technically important inorganic and organic compounds; industrial estimations.

(*c*) Preparation of paints and varnishes.

B. *Chemical Engineering Laboratory.*—Crushing, grinding, mixing—Temperature measurement—Flow of liquids; flow of heat. Leaching, crystallisation—use of centrifuge—Filter presses—Autoclave, distillation.

C. *Oil Technology.*—Practical. Iodine value, Saponification values, Reichest Meissel value, Acetyl value; optical activity. Viscosity; Refractivity.

Detection of adulteration. Analysis of edible oils. Detection of animal and vegetable oils in each other. Hydrogenation of oils. Paint oils.

D. *Testing Laboratory.*—Testing of materials; heat engines; dynemos, motors.

E. *Fuel Technology Laboratory.*—Assay of solid, liquid and gaseous fuels. Distillation of coal, tar, wood.

13. *Workshop.*—Use of tools—Fitting, chipping, filing gauges, soldering, drilling, boring, lathe, smithy, carpentry.

VII. Text-Books.—

1. Badger and Baker—Inorganic Chemical Technology.
2. G. Martin—Industrial Chemistry (2 vol.)
3. Rogers—Industrial Chemistry (2 vol.)
4. Riegel—Industrial Chemistry.
5. R. B. Leighow—Chemistry of Engineering Materials, 4th Edn.
6. Houghen and Watson—Industrial Chemical Calculation.
7. Lewis and Radisch—Industrial Stoicheometry.
8. Walker, Lewis, McAdams and Gitliland—Principles of Chemical Engineering.
9. Badger and McAbe—Elements of Chemical Engineering.
10. Olsen: Chemical Engineering Unit Processes and Principles.
11. Groggins—Unit processes of organic Synthesis.
12. McCarmack—Applications of Chemical Engineering.
13. Liodell—Hand-book of Chemical Engineering (2 vol.)
14. Hand-book of Chemical Engineering by Perry.
15. Sherwood and Read—Applied Mathematics for Chemical Engineers.
16. Lewkowitch—Chemical Technology and Analysis of oils, fats and waxes.
17. Ellis—Hydrogenation of oils.
18. Martin—The Modern Soap and Detergent Industry.
19. Low—Applied Mechanics.
20. Low—Heat Engines.
21. Lewitt—Hydraulics.
22. Gray and Wallace—Principles and Practice of Electrical Engineering.

SYLLABUS FOR ROAD AND MINOR IRRIGATION OVERSEER CLASS

(TWO YEARS' COURSE)

Syllabus for the First Year

Mathematics.

Computation.—Approximations—Limits of error use of Logarithmic tables—Evalution of formulæ—Use of squared paper—Interpolation—Graphical solution of simple problems.

Mensuration.—Area and perimeter of plane rectilinear figures—Area of ellipse, sector and segment of a circle. Length of circumference and area of circle—Areas of perimeters of similar figuers—Area of irregular plane figure by mid-ordinate rule and Simpson's Rule.

Plane Trigonometry.—Measurement of angles in degrees and radians. Definition of trigonometrical ratios of an angle and graphical determination of their values. Setting out angles from values of sine, cosine, etc. Use of tables of sine, cosine etc.

Sketching and Machine Drawing.

i. *Free hand model drawing.*—Ornamental outlines. Application of elementary perspective to model drawing of simple objects.

ii. *Machine Drawing.*—Ability to copy accurately to scale and supply additional views. Drawings of simple machine parts from sketches and from measurements.

iii. *Geometrical Drawing.*—Elementary problems dealing with lines, triangles, quadrilaterals, circles, polygons, method of drawing plane curves, parabola, ellipse, rectangular hyperd qola. Lines, points and planes. Projection of simple solids. The simple regular solids Sections of solids.

Building Drawing.—The work will be based on the syllabuses in construction and hydraulic engineering.

Applied Mechanics.

i. *Stress and strain.*—Tension and compression. Hooke's law. Modulus of elasticity. Elastic limit. Ultimate strength. Factor of safety and working stress.

ii. *Elementary statics.*—Parallelogram, triangle and polygon of forces. Easy graphical applications to ordinary frames. Wind pressure on roofs. Centre of gravity.

iii. *Elementary study of beams.*—Bonding moment and shearing force. Sections in steel, wood.

Building materials and construction.

i. *Stone.*—Varieties—Quarrying—Blasting—Dressing.

ii. *Bricks and Tiles.*—Brick earth—Tempering, hand and machine moulding. Drying. Prossed bricks tiles. Ordinary, patent and special Characteristics of good tiles and bricks.

iii. *Lime, cement mortar, concrete plaster.*—Sources and properties of lime. Burning, slaking, mortar mixing, cement, surki, concrete. Tests for limes and cements. Plastering, pointing. White and colour washing,

iv. *Timber.*—Seasoning and preservation of timber Varieties of timber used in Southern India. Strength and weight of timber. Characteristics of good timber

v. *Paints and Varnishes.*-Ingredients of paint, litharge turpentine, linseed oil. Mixing paint. Painting old and new work Wood oil. Coaltar. Varnish. Putty. Glazing.

vi. *Masonry.*—Coursed and uncoursed rubble bond in brick-work. Foundations and footings. Wall plates. Wood bricks and plugs. Openings for timber beams for door and windows. Cobelling.

vii. *Carpentry.*—Mortise and teapon joint. Fishing and scaring. Iron straps and belts. Simple roof and bridge frames. Detail of joints. Frames of timber and iron combined. Doors and windows.

viii. *Roofs and floors.*—Pitched roofs. Couples. Trusses. Rafters, purlins and reepers. Roof covering. Terrace roofs on, joists and beams. R. C. beams and terrace. Floors of stone brick, tiles, cement concrete, timber and ashpalte Simple forms of iron roofs. Ventilators.

Surveying :

i. *Chain, compass, and Plane table.*—Ordinary surveying with chain, compass and plane table. Inaccessible points obstructed lines. Use of optical square and cross staff.

ii. *Level.*—Manipulation and adjustment of level. Levelling. Contouring. Cross sections. Use of Abney's level, clinometer and ghaut tracer.

Syllabus for the Second Year.

Mensuration.—Surface and volume of Prism, Cylinder, pyramid, cone, sphere, ring. Surface and volumes of frusta of prisms, pyramids cones and of sectors and segments of spheres, volume of prismoids.

Plane Trignometry.—Solution of right-angled triangles by calculation and drawing. Simple applications to heights and distances.

Machine Drawing.–Advanced drawings of machine parts. Ability to supply some idea of proportions of the more simple machine details such as bolts, nuts, keys, cotters etc.

Building Drawing.—Advanced exercises based on syllabuses in construction and hydraulic Engineering.

Applied Mechanics.—

i. *Simple Shear.*–Examples of applications in ordinary application structures.

ii. *Strength of beams of timber Steel and R. C.*—Application of simple formulae.

iii. *Design.*—Easy applications of theory and the use of empirical formulae in the design of small bridges, arches and retaining walls.

iv. *Principle of work.*—Graphic representation, simple applications to machines. Potential and kinetic energy. Power, Horse-power and Friction.

v. *Specific Gravity.*—Weights of Materials.

Roads and Bridges.—

i. General principles of location, alignment and construction of roads—subsoil and drainage.

ii. Road resistance–tractive effort and ruling gradients. Camber on metal roads, survey, construction of metal roads in plain and hilly country.

iii Modern Road Construction. Camber and width of roads, Pavements for cities–Kinds of Roadway–Tar Bitumen asphalt–cement, concrete and methods of using them for road work. Specifications—Road rollers—modern appliances used for road making.

iv. Wear on roads. Influence of wheels, tyres, speed conditions of road surface.

v. Construction of culverts, causeways and bridges. Elementary principles relating to their designs.

vi. Earthwork and other details of railway permanent way.

Hydraulics and Irrigation

i. *Tanks and Channels*—Supply from wells, tanks and rivers. Discharge from catchment areas, Construction of—

tank bunds, escapes and irrigation sluices. Use of simple formulae for the discharge of escapes and–sluices. Discharge of channels. Permissible limits of fall and velocity in channels. Laying out and construction of channels. Regulation of supply from head sluices.

ii. *Wells.*—Locating sites for wells—geology of water bearing strata—Yield of wells—Boring tools and Boring. Well sinking and steining. Pumps including deep well and bore hole pumps. Water lifts. Piccotah Mhote. Persian wheel, wind-mills.

iii. *Rural Water supply.*—Provision of safe water supply in rural area.

SURVEYING

Theodolite.—Elementary use and adjustment of theodolites. Simple triangulation and traversing. Gale's system. Setting out straight lines and curves in the fields.

Topographical Drawing.—Conventional signs, map drawing—Representation of ground by contours. Sections on contoured plans. Location of dams, roads and railways on contoured plans, showing cuttings and embankments. Estimation of areas and volumes.

MECHANICAL ENGINEERING

Fastenings:—Bolts, nuts, keys and cotters, riveted joints and connections generally, pipes and cylinders.

Transmission of Motion and Power.—Shafts, couplings, clutches, pedestals, and wall fixings. Belts, ropes, and pulleys. Toothed gearing, spur and bevel wheels rack and pinion, worm gearing, cams. Examples of uses of above in ordinary machines.

Boilers.—General description of common types. Boiler—accessories and mountings.

Steam and other heat Engines.—General description of—modern steam engines. Types of gas and oil engines steam turbines—general arrangement of a Power House.

Hydraulic Machinery.—Plunger, Centrifugal and turbine pumps, Pelton wheel, inward and outward flow turbines.

Machine tools.—General description of lathes, drilling, shapping and milling machines. Arrangement of shafting and belting in a machine shop.

ELECTRICAL ENGINEERING

General.—Electric and Magnetic circuits, conductivity and insulation of materials, measuring instruments direct current, priciple of alternating currents in single, two and three phase circuits.

Electric Machinery.—Description, principles of working and maintenance, characteristics of direct current and alternating current generators and motors.

As III
1946-47
ASST. SECRETARY TO GOVERNMENT
EDUCATION AND PUBLIC HEALTH DEPT.

APPENDIX A

COURSE, SCHEME OF EXAMINATION AND SYLLABUSES

FOR

B. E., Degree ; B. Sc. (Tech.). Degree and Overseer Diploma

—o—

Degree of Bachelor of Engineering :

1. Candidates for the degree of Bachelor of Engineering (B. E.), shall be required to have passed the Intermediate Examination of this University with Mathematics, Physics, and Chemistry as optional subjects or any other examination recognised as equivalent thereto and to have subsequently attended the University College of Engineering for a period of not less than four academic years. They shall be further required to have passed the examinations mentioned below :—

First year	Intermediate	Engineering	Examination	Part I
Second year	do.	do.	do.	,, II
Third year	B. E.	Degree	do.	,, I
Fourth year	do.	do.	do.	,, II

The syllabuses for the course shall be prescribed from time to time by the Academic Council on the recommendations of the Board of Studies.

2. A candidate appearing for any of the above Engineering examinations shall produce a certificate of good conduct and of having attended at least 80 per cent. of (i) the lectures and (ii) the practical classes. No exemption shall ordinarily be given. In no case will any candidate be admitted to the examination if the attendance is less than 70 per cent.

3. All sessional work is valued and marks awarded by the members of staff and a certificate of progress given by the Head of the department. The Dean of the Faculty shall recommend to the Registrar the names of candidates who can be sent up for the examination on the basis of the conduct and progress in class work during the academic year. Candidates who do not show satisfactory progress will not be sent for the examination. Such candidates may be permitted to repeat the course once.

Intermediate Engineering Examination—Part I

4. A candidate for the Intermediate Engineering Examination Part I shall be required to have attended the University college of Engineering for a period of not less than one academic year.

5. The scheme of instruction and examination shall be as hereunder :—

Subject	Hours of Instruction per week	Examination		
			Duration	Maximum Marks
1. Mathematics Pure	6		3 hrs.	100
2. do. Applied			3 hrs.	100
3. Applied Mechanics	1+2	Graphic Statics	3 hrs.	100
4. Physics	2		3 hrs.	100
5. Chemistry	2		3 hrs.	100
6. Civil Engineering	2		3 hrs.	100
7. Surveying	1		3 hrs.	100
8. Geometrical Drawing	4		3 hrs.	100
9. Survey practical	4		3 hrs.	100
10. Workshop practical	4		3 hrs.	100
			Total ..	1000
11. Physics practical	2	No University Examination. Special report on progress of work to be produced by candidates.		
12. Chemistry practical	2			
13. Field Engineering	2			
14. English Composition	1			
Total	35			

6. Candidates who obtain not less than 30% of the marks in each subject separately in Theory and Practical and not less than 40% of the aggregate marks assigned for the whole examination shall be deemed to have passed the Intermediate Engineering Examination in Part I. All other candidates shall be deemed to have failed in the examination.

Candidates failing in the examination, but passing in any subject or subjects by obtaining not less than 50% of the marks shall be exempted from reappearance for the Examination in that subject or subjects.

Intermediate Engineering Examination—Part II

7. Candidates for the Intermediate Engineering Examination Part II shall be required to have passed the Intermediate Engineering Examination Part I and thereafter to have attended the University College of Engineering for a period of not less than one academic year.

8. The scheme of instruction and examination shall be as hereunder :—

Subject	Hours of Instruction per week	Examination	
		Duration	Maximum Marks
1. Mathematics	3	3 hrs.	100
2. Applied Mechanics	2+2 G.S.	3 hrs.	100
3. Civil Engineering	2	3 hrs.	100
4. Mechanical Engineering	2	3 hrs.	100
5. Electrical Engineering	2	3 hrs.	100
6. Surveying	1	3 hrs.	100
7. Building Drawing	3	3 hrs.	100
8. Machine Drawing	3	3 hrs.	100
9. Survey practical	4	3 hrs.	100
10. Workshop practical	4	3 hrs.	100
		Total ..	1000
11. Strength of materials laboratory	2	No University Examination. Special report on progress of work to be produced by the candidates.	
12. Mechanical Engineering laboratory	1		
13. Electrical Engineering laboratory	2		
14. Field Engineering	2		
Total ..	35		

Students will go for survey camp for 2 weeks.

9. Candidates who obtain not less than 30% of the marks in each subject separately in Theory and Practical and not less than 40% of the aggregate marks assigned for the whole examination shall be deemed to have passed the Examination. There will be no class and ranking. All other candidates shall be deemed to have failed in the examination.

Exemption from reappearance in subjects passed will be as per sub-para of Regulation 6 above.

B. E. Degree Examination—Part I

10. Candidates for the B. E. Degree Examination in Engineering Part I, shall be required to have passed the Intermediate Engineering Examination in Part II and thereafter to have attended the University College of Engineering for not less than one academic year. They shall be further required to have specialised in one of the branches—Civil, or Mechanical or Electrical Engineering.

11. Candidates in each branch shall be instructed and examined in the following subjects prescribed in accordance with the schemes detailed below :—

I. Civil Engineering

Subject	Hours of Instruction per week	Examination Duration	Maximum Marks
1. Mathematics*	3	3 hrs.	100
2. Strength of materials & Theory of Structures*	2+2	3 hrs.	100
3. Hydraulics*	1	3 hrs.	100
4. Structural Engineering	2+4	3 hrs.	100
5. Geology	1+1	3 hrs.	100
6. Communication Engineering (Railways and Highways)	2	3 hrs.	100
7. Surveying	1	3 hrs.	100
8. Quantity Surveying (Estimating)	3	3 hrs.	100
9. Design & Drawing (Included under item 4)		3 hrs.	100
10. Survey practical	5	3 hrs.	100
11. Workshop practical	2	3 hrs.	100
		Total ..	1100
12. Strength of materials Laboratory	3	No University Examination. Special certificate of progress of work to be produced by candidates.	
13. Hydraulics Laboratory	3		
Total ..	35		
14. Survey camp (2 weeks)	—		

* Paper Common to all the 3 branches-Civil, Mechanical & Electrical.

II. Mechanical Engineering

Subject	Hours of Instruction per week	Examination Duration	Maximum Marks
1. Mathematics	3	3 hrs.	100
2. Strength of materials & Theory of structure	2+2 G.S.	3 hrs.	100
3. Hydraulics	1	3 hrs.	100
4. Structural Engineering † (special papers)	1	3 hrs.	100
5. Automobile Engineering	2	3 hrs.	100
6. Heat Engines †	2	3 hrs.	100
7. Electrical Technology	2	3 hrs.	100
8. Machine drawing and Design	4	3 hrs.	100
9. S. M. Laboratory	3	3 hrs.	100
10. Electrical Engg. Lab.	3	3 hrs,	100
11. Workshop	4	3 hrs.	100
		Total ..	1100

† Paper common to mechanical and electrical branches.

12. Hydraulic Laboratory	3	No University Examination. Special certificate of progress of work to be produced by candidates.
13. Mechanical Engineering Laboratory	3	
Total	35	

III. Electrical Engineering

Subject	Hours of Instruction per week	Examination Duration	Maximum Marks
1. Mathematics	3	3 hrs.	100
2. Strength of materials and Theory of structures.	2+2 G.S.	3 hrs.	100
3. Hydraulics	1	3 hrs.	100
4. Structural Engineering	1	3 hrs.	100
5. Heat Engines	2	3 hrs.	100
6. Theory and calculation of Electrical Apparatus	3	3 hrs.	100
7. Design and Drawing	5	3 hrs.	100
8. S. M. Lab. Test.	3	3 hrs.	100
9. Mechanical Engineering Lab Test	3	3 hrs.	100
10. Electrical Lab.	3	3 hrs.	100
11. Workshop	4	3 hrs.	100
		Total ..	1100
12. Hydraulic Engg. Lab.	3	No University examination. Certificate of progress to be prduced by candidates.	
Total ..	35		

12. Candidates who obtain not less than 30% of the marks in each subject separately in Theory and Practical and not less than 50% of the aggregate marks assigned for the whole examination in each branch shall be deemed to have passed the Examination in Part I in that branch. All other candidates shall be deemed to have failed in the examination.

B. E. Degree Examination—Part II

13. Candidates for the B. E. Degree Examination Part II shall be required to have passed the B. E. Degree Examination Part I and thereafter to have attended the University College of Engineering for a period of not less than one academic year and to have continued their specialised study in the respective branches, provided however, a candidate failing in Part I of the B. E. Degree Examination in any one subject by a deficiency of

not more than 10% of the marks but obtaining 50% in the aggregate shall be permitted to join the fourth year course for B. E. Degree Examination Part II in the branch selected and appear for both the parts of the Degree Examination together. He shall be exempted from appearing for the examination in Part I in the subjects already passed.

14. The candidates in each branch shall be instructed and examined in the following subjects in accordance with the scheme detailed below :—

I. Civil Engineerning

Subject	Hours of Instruction per week	Examination Duration	Maximum Marks
1. Theory of structures	1+2 G.S.	3 hrs.	100
2. Structural Engineering	2+4	3 hrs.	100
3. Hydraulics & Hydraulic machinery	1	3 hrs.	100
4. Sanitary Engineering	2+2	3 hrs.	100
5. Irrigation Docks and Harbours Engineering	3+4	3 hrs.	100
6. Hydro Electric Engineering*	1	3 hrs.	100
7. Geodesy	1	3 hrs	10
8. Design and Drawing (Included under item 2, 4 & 6)	..	3 hrs.	100
9. S. M. Lab.	3	3 hrs.	100
10. Hydraulic Lab.	3	3 hrs.	100
11. Project †		4 weeks	200
12. Quantity surveying‡ (estimating)	3	No University Examination	
13. Survey Practical ‡	3		
Total	.. 35	Total ..	1200

* Common to Civil, Mechanical and Electrical branches.

† Detailed working out of an actual or a possible scheme of construction or repairs, relating to any branch of Civil Engineering complete with survey and investigation, design and drawings, bills of quantities and estimate of cost with report and necessary explanatory notes.

‡ Special certificate of progress to be produced for estimating, surveying, design and drawing etc. by candidates.

II. Mechanical Engineering

Subject	Hours of Instruction per week	Examination Duration	Maximum Marks
1. Heat Engines*	2+3	3 hrs.	100
2. Electrical Technology	2	3 hrs.	100
3. Theory of machines	2	3 hrs.	100
4. Hydraulics & hydraulic machinery*	2	3 hrs.	100
5. Fuels, gasplant, boilers	2	3 hrs.	100
6. Hydro electric Engineering	1	3 hrs.	100
7. Workshop practice and machine tools	2	3 hrs.	100
8. Engineering Economics	2	3 hrs.	100
9. Design and Drawing	4	3 hrs.	100
10. Mechanical Engg. lab.	3	3 hrs.	100
11. Hydraulic Engg. lab.	3	3 hrs.	100
12. Workshop	4	3 hrs.	100
		Total ..	1200
13. Electrical Engg. lab	3	(No University Examination)	
Total ..	35		

* Common to mechanical and electrical branches (Nos. 1 & 4).
Special certificate of progress of work to be produced for labs and drawings by candidates.

III. Electrical Engineering

Subject	Hours of Instruction per week	Examination Duration	Maximum Marks
1. Heat Engines	2+3	3 hrs.	100
2. Electric Theory and measurement	3	3 hrs.	100
3. Theory and Calculation of Electric Apparatus	3	3 hrs.	100
4. Hydraulics & hydraulic machinery	2	3 hrs.	100
5. Generation & Utilisation	3	3 hrs.	100
6. Hydro electric Engineering	1	3 hrs.	100
7. Transmission and distribution	3	3 hrs.	100
8. Design and Drawing	4	3 hrs.	100
9. Elect. Engg. lab. test	3	3 hrs.	100
10. Hydraulic Engg. lab.	3	3 hrs.	100
11. Projects		4 weeks	200
		Total ..	1200
12. Mechanical Engg. lab.	3	No University Examination	
13. Workshops	2		
Total ..	35		

Special certificate of progress of work for mechanical lab and workshop and drawing to be produced by candidates.

15. Candidates who obtain not less than 30% of the marks in each subject separately in Theory and Practical and not less than 50% in the aggregate marks assigned for the whole examination shall be deemed to have passed the examination in Part II. All candidates passing Parts I and II of the Degree Examination in Engineering at the first attempt shall be ranked in the order of proficiency as determined by the total marks obtained by them in both parts and shall be arranged in two classes, the first class consisting of those securing not less than 60% of the aggregate marks and the second class consisting of all the others. Candidates obtaining not less than 66⅔% of the aggregate marks shall be deemed to have passed the Degree Examination with Honours.

16. The candidates to obtain the degrees should have completed 6 months practical training of which 3 months may be during the college course.

Note :—During the course in the University College of Engineering and Technology, endeavour will be made to give facilities to the students to visit works of importance and the students will be required to submit notes on visits to those works.

DIPLOMA FOR OVERSEERS

1. Candidates for this Diploma shall be required to have successfully completed the Madras Secondary School Leaving Certificate with mathematics or physics as optionals and have been declared eligible for admission to a University course of study or have passed the Matriculation examination of a recognised University or any other examination accepted by the Syndicate as equivalent thereto and to have subsequently attended the University College of Engineering for a period of not less than two academic years. They shall be required to pass the following examinations.

(a) the first examination at the end of the 1st year course and (b) the second and final examination at the end of the second year course.

2. All sessional work will be valued and marks awarded by the members of staff and certificate of progress given by the head of the department. Rules regarding attendance, character and progress of work will be as per regulations 2 & 3 of the Engineering Degree examinations.

3. Candidates for the first examination shall be instructed and examined in the following subjects in accordance with the following scheme.

First Examination

Scheme of Instruction and Examination

Subject	Hours of Instruction per week	Examination Duration	Examination Maximum Marks
1. Mensuration & Computatoin	3	3 hrs.	100
2. Plane Trigonometry		3 hrs.	100
3. Applied Mechanics (including graphic statics)	1+2	3 hrs.	100
4. Building materials	2	3 hrs.	100
5. Building construction	2	3 hrs.	100
6. Surveying	1	3 hrs.	100
7. Geometrical drawing	4	3 hrs.	100
8. Sketching & machine drawing	3	3 hrs.	100
9. Building Drawing	4	3 hrs.	100
10. Quantity Surveying	2	3 hrs.	100
11. Workshops Practical	2	3 hrs.	100
12. Surveying Practical	6	3 hrs.	100
		Total ..	1200
13. Field Engineering	2	No University examination.	
14. English composition	1		
Total	35		

Certificate of progress in field engineering, English composition, drawing and other class work to be produced by the candidates.

4. Candidates obtaining 35% in each of the subjects in Theory and Practical separately and obtaining 40% in the aggregate shall be deemed to have passed. No candidate shall be permitted to proceed to the second year course unless he has passed the first examination. However a candidate who fails in the first examination, in any one subject by a deficit of not more than 10% of marks, may be permitted to proceed to higher class and repeat the examination.

5. Candidates for the second and Final examination shall be examined in the following subjects in accordance with the following scheme :—

Subject	Hours of Instruction per week	Examination Duration	Maximum Marks
1. Applied Mechanics (includes graphic statics)	2+2	3 hrs.	100
2. Roads & Bridges	3	3 hrs.	100
3. Hydraulic & Irrigation	3	3 hrs.	100
4. Surveying	1	3 hrs.	100
5. Quantity surveying, (estimating) (Roads & Irrigation)	3	3 hrs.	100
6. Elementary Electrical & Mechanical Engineering	2	3 hrs.	100
7. Civil Engg. Drawing	4	3 hrs.	100
8. Machine Drawing	4	3 hrs.	100
9. Workshops Practical	3	3 hrs.	100
10. Survey Practical	6	3 hrs.	100
		Total ..	1000
11. Field Engineering	2	No University Examination	
Total	35		

Students will go on survey camps for 2 weeks.
Certificate of progress to be produced for every practical work during the session.

6. The syllabuses for the course shall be prescribed from time to time by the Academic Council on the recommendations of the Board of Studies.

7. Candidates who obtain at the above examinations not less than 40% in each subject separately in theory and practical and not less than 50% of the total marks alloted for the written papers and practical examination separately shall be deemed to have passed in that examination. All other candidates shall be deemed to have failed in the examination. Candidates who fail in the second and final examination may rejoin the 2nd year class if permitted.

8. Successful candidates in the final examination shall be arranged in two classes and ranked according to proficiency, the first consisting of those who obtain not less than 66⅔ per cent. and the second of those obtaining not less than 50% of the II year marks if each part is completed in the first attempt.

9. Candidates should in addition complete 3 months practical training on works.

10. A Diploma will be granted to each candidate who is successful at the final examination after completion of the above practical training.

NOTE :—During the course in the University College of Engineering and Technology, endeavour will be made to give facilities to the students to visit works of importance and the students will be required to submit notes on *visits to those works*.

B. Sc. (Technology) Degree

1. Candidates for the Degree of Bachelor of Technology B.Sc (Tech)., shall be required to have passed the Intermediate Examination of this University with Mathematics, Physics, and Chemistry as optional subjects or any other examination recognised as equivalent thereto and to have subsequently attended the University College of Technology for a period of not less than four academic years. They shall be further required to have passed the examinations mentioned below:—

First year	Intermediate	Technology	Examination	Part I
second year	do	do	do	,, II
Third year	B. Sc.	do	do	,, I
Fourth year	do	do	do	,, II

The syllabuses for the course shall be prescribed from time to time by the Academic Council on the recommendations of the Board of Studies.

2. A candidate appearing for any of the above Technology examinations shall produce a certificate of good conduct and of having attended at least 80 per cent. of (i) the lectures and (ii) the practical classes. No exemption shall ordinarily be given. In no case will any candidate be admitted to the examination if the attendance is less than 70 per cent.

3. All sessional work is valued and marks awarded by the members of staff and a certificate of progress given by the Head of the department. The Dean of the Faculty shall recommend to the Registrar the names of candidates who can be sent up for the examination on the basis of the conduct and progress in class work during the academic year. Candidates who do not show satisfactory progress will not be sent for the examination. Such candidates may be permitted to repeat the course once.

Intermediate Technology Examination—Part 1

4. A candidate for the Intermediate Technology examination Part I shall be required to have attended the University college of Technology for a period of not less than one academic year.

5. The scheme of instruction and examination shall be as hereunder.

B. Sc. (Technology) 1 year

Subject	Hours per week	Scheme of Examination. Subject	Paper	Duration	Marks
Lectures					
Inorganic Chemistry	1	Physics Theory	1	3	100
Organic Chemistry	2	do Practical		3	100
Physical Chemistry	1	Engg. Mechanics	1	3	100
Physics	3	German	1	2	100
Mathematics	2	Drawing-Geom.	1	3	100
Engg. Mechanics	1				
German	2		Total	..	500
Practical.					
Qualit. Analysis (I & II terms)	9				
Quant. Analysis (III term)	9				
Physics Pract.	3				
Drawing	4				
Workshop	2				
Total ..	30				

6. Candidates who obtain not less than 30% of the marks in each subject separately in Theory and Practical and not less than 40% of the aggregate marks assigned for the whole examination shall be deemed to have passed the Intermediate Technology Examination in Part I. All other candidates shall be deemed to have failed in the examination.

Candidates failing in the examination but passing in any subject or subjects by obtaining not less than 50% of the marks shall be exempted from reappearance for the examination in that subject or subjects.

Intermediate Technology Examination—Part II

7. Candidates for the Intermediate Technology Examination Part II shall be required to have passed the Intermediate Technology Examination Part I and thereafter to have attended the University College of Technology for a period of not less than one academic year.

8. The scheme of instruction and examination shall be as hereunder :

B. Sc. (Technology) II Year

Subject	Hours per week	Scheme of Examination Subject	Paper	Duration	Marks
Lectures					
Mathematics	2	Mathematics	1	3	100
Inorganic Chemistry	1	Applied Mechanics	1	3	100
Organic Chemistry	3	Elect. Engg.	1	3	100
Physical Chemistry	2	Chem. Inorganic	1	3	100
Applied Mechanics	1	Organic	1	3	100
Elect. Engg.	1	Physical	1	3	100
		Drawing (Machine)	1	3	100
Practical		*Practical*			
Chemistry Gravimetric (I term only)	9	Chemistry Inorganic		6	100
Chemistry Organic and		Organic		6	100
Physical (II&III terms only)	12	Workshop		3	100
Elect. Engg. Lab.	2	Elect. Engg. Pract.		3	100
Workshop			Total	..	1100
Drawing & Sketching	4				
Survey (I term only)	3				
Total ..	30				

9. Candidates who obtain not less than 30% of the marks in each subject separately in Theory and Practical and not less than 40% of the aggregate marks assigned for the whole examination shall be deemed to have passed the Examination. There will be no class and ranking. All other candidates shall be demeed to have failed in the examination.

Exemption from re-appearance in subjects passed will be as per sub-para of Regulation 6 above.

B. Sc. (Technology) Degree Examination Part I.

10. Candidates for the B. Sc. (Tech.) Degree Examination in Technology Part I shall be required to have passed the Intermediate Technology Examination in Part II and thereafter to have attended the University College of Technology for not less than one academic year.

11. Candidates shall be instructed and examined in the following subjects prescribed in accordance with the schemes detailed below :—

B.Sc. (Tech.), III Year

Subject	Hours per week	Scheme of Examination: Subject	Paper	Duration	Marks
General Chemical Engg.	3	General Chemical Engg.	1	3	100
General Chemical Technology	3	General Chemical Technology	1	3	100
Fuel Technology	1	Fuel Tech & Industrial Stoichiometry	1	3	100
Industrial Stoichiometry	1	Physical Chem.	1	3	100
Applied Physical Chem.	2	Heat Engines	1	3	100
Heat Engines	1				
Practical		*Practical*			
General Chem. Tech	10	General Chem. Egg.		6	100
Fuel Technology	1	General Chem. Tech.	I	6	100
Applied Physical Chem.	4	,, ,, ,,	II	6	100
Engg. Lab	4	Heat Engines		3	100
Drawing	2	Applied Physical Chem. & Fuel Technology		6	100
Total :	32	Total :			10000

12. Candidates who obtain not less than 30 % of the marks in each subject separately in Theory and Practical and not less than 50% of the aggregate marks assigned for the whole examination shall be deemed to have passed the Examination in Part I. All other candidates shall be deemed to have failed in the examination.

B.Sc. (Tech) Degree Examination—Part II

13. Candidates for the B.Sc. (Tech) Degree Examination Part II shall be required to have passed the B.Sc. (Tech) Degree Examination Part I and thereafter to have attended the University College of Technology for a period of not less than one academic year and to have specialised in one of the following

subjects or such other subjects as may be included from time to time, provided however a candidate failing in Part I of the B. Sc. (Tech) Degree Examination in any one subject by a deficiency of not more than 10% of the marks but obtaining 50% in the aggregate shall be permitted to join the fourth year course (for Part II of the degree Examination) and appear for both the parts of the Degree Examination together. He shall be exempted from appearing for the examination in Part I in subjects already passed.

14. The candidates shall be instructed and examined in the following subjects in accordance with the scheme detailed below:—

B. Sc. (Tech.)—IV Year.

Subject	Hours per week	Scheme of Examination: Subject	Paper	Duration	Marks
Industrial Economics	3	Industrial Economics and Administration.	1	3	100
The rest of the time will be devoted to theory and practical of the special subject	27	Special subject theory and practical.	..	..	900
	30				1000

Candidates who obtain not less than 30% of the marks in each subject separately in Theory and Practical and not less than 50% in the aggregate marks assigned for the whole examination shall be deemed to have passed the examination in Part II. All candidates passing Parts I & II of the Degree Examination in Technology on the first attempt shall be ranked in the order of proficiency as determined by the total marks obtained by them in both parts and shall be arranged in two classes, the first class consisting of those securing not less than 60% of the aggregate marks and the second class consisting of all the others. Candidates obtaining not less than $66\frac{2}{3}$% of the aggregate marks shall be deemed to have passed the Degree Examination with honours.

16. The candidates to obtain the degree should have completed 6 months practical training of which 3 months may be during the college course.

Note:—During the course in the University College of Engineering & Technology, endeavour will be made to give facilities to the students to visit works of importance and the students will be required to submit notes on visits to those works.

B. E. Degree Examination

SYLLABUSES

INTERMEDIATE (ENGINEERING) EXAMINATION—PART I.

Mathematics

Pure Mathematics:—Elementary tests of convergence and divergence of series, binomial, exponential and logarithmic series, De Moivre's Theorem, series for sin x, cos x, $\tan^{-1}x$, hyperbolic functions, graphical study of algebraic, exponential, logarithmic and trigonometric functions, elements of the theory of equations.

Analytical geometry of the straight line and the circle. Properties of the parabola, ellipse and hyperbola, polar co-ordinates and curves with simple equations therein.

Differentiation with simple applications to geometry and to mechanics, approximations and small errors, maxima and minima, theorem of mean value, curvature, geometrical properties of the cycloid epi—and hypocycloids, catenary etc., partial differentiation Taylor's and Maclaurin's series.

Applied Mathematics: Parallelogram law of vector addition, displacements, velocities, accelerations, and forces as vectors, resolution of vectors, moments, parallel forces, couples, equilibrium of forces in one plane, graphical methods, friction, stability, centre of gravity, virtual work, equilibrium of a heavy uniform chain, the parabolic catenary, light string on rough curve.

Relative velocity and acceleration, Newton's Laws of Motion, one dimensional motion under a constant acceleration, simple harmonic motion, projectiles, motion in a horizontal circle, motion in a vertical circle, the pendulum, impact.

Applied Mechanics

Statics: Coplaner 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: Calculations and graphical determination of areas, positions of centroid, neutral axis, moments of inertia, modulus of section and radii of gyration with special reference to structural shapes. Physical properties of materials commonly used in engineering.

Simple stresses and strains: compressive, tensile shearing and bearing stresses, Hook's law stress-strain and load extension curves; dead live and shock loads; factors of safety and working stresses; work and resilience; elastic modulii. Poisson's ratio and relation between elastic constants; temperature stresses; composite bars.

Resilience and fluctuating stresses.

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.

Physics

Heat.—Temperature and its measurements—Thermometer, pyrometers—expansion of solids, liquids and gases. Calorimetry and calorimeters. Vaporisation, evaporation and ebullition—Effect of pressure on the boiling point—Saturated vapours—Critical constants—conduction of heat, convection, radiation, laws of cooling—Laws of Thermo-dynamics—Carnot's Cycle.

Light.—Optical properties and applications of parabolic and cylindrical mirrors, cylindrical and prismatic lenses and totally reflecting prisms. Spherical and chromatic aberration, defects in images due to these and methods of minimising the defects, Dispersion and spectrum analysis. The study of the sextant, telescope, microscope, range-finders and eye-pieces. (Huyghen, Riamsden, and Terrestial) Polarisation with simple applications.

Magnetism and Electricity.—Magnetic poles; lines of force; forces and couples on magnets in the magnetic field. Direction of fields due toc urrent in a straight wire and coils. The effect of introducing an iron core in the magnetic circuit. Induced magnetisation, Magnetic properties of iron and steel, Hysterisis. Standard cells; current. E. M. F. Ohm's law. Electrical units, specific resistance. Measurement of resistances, Conductors in series and parallel. Drop of potential.

Sound—Reflection and absorption—Reverberation, Acoustic demands etc.

Chemistry.

A. Elementary Applied Physical Chemistry:

Gas laws, Refrigeration and liquefaction of gases—Critical points, Joule-Thomson effect. Principle of counter current systems. Henry's law of partial pressures. Solubility: partition co-efficient—miscible, non-miscible and partly miscible systems. Hess law of heat summation-cumbustion calculations on fuels. Catalysis with examples on oxidation—hydrogenation—elementary phase rule with reference to alloys under B.—Colloids—sols—gels—ieversible and irreversible colloids—their properties.

Elementary treatment of the Electrolytic dissociation theory and its application to electro-plating with detail as regards choice of electrolyte—C. D. and efficiency etc. Ph. values and their importance.

B. Chemistry of Engineering materials:—

1. Water. Sources of impurities—water softening—boiler scale deposits—wet steam—foaming and priming—corrosion prevention.

2. *Fuels and lubricants.*—Types of fuels—solid fuels—(i) Classification—analysis of coal—calorific value—powdered coal—charcoal and coke.

Liquid fuels—Tar—alcohol—colloidal fuel—fuel oil and their calorific value—Diesel engine fuel—kerosene—gasoline antiknock motor fuel.

Gaseous fuel.—Natural gases—Producer gas—water gas—Blast furnace gas—coke oven gas—coal gas—oil gas.

Principles of combustion.—Ignition temperature—weight and volume relations in combustion—heats of combustion—heat capacities—Heat and material balances.

Petroleum refining.—Products from crude oil—cracking hydrogenation—Blending.

Lubricants.—Description—properties—greases.

3, *Refractories.*—Description of Types of refractories—thermal conductivities and specific heats of refractions.

4. *Non-ferrous metals.*—Aluminium—Copper—Lead—Tin—Zinc—Cadmium—Magnesium—Cobalt—Manganese—Chromium—Tungsten—Molybedenum—Vanadium—Bismuth—Antimony—Mercury—Titanium.

(Only metallurgy and Engineering properties)

5. *Non-ferrous alloys.*—Phase rule treatment of alloys—alloys of copper—Aluminium alloys—Magnesium alloys—Nickel alloys—Bearing alloys—alloys of soldering and brazing—Low melting alloys.

6. *Iron and Steel.*—Blast furnace-Bessemer and open hearth process. Wrought Iron—Cast Iron and Steel—properties—Metallography.

7. *Alloy Steels.*-With Carbon, Nickel, Chromium, Tungsten Molybodenum and Vanadium. High speed tools.

8. *Corrosion of Iron.*—Electro-chemical ideas of corrosion—corrosive prevention.

9. *Lime and Gypsum.*—Mortars and plasters.

10. *Cement.*—Properties—setting and hardening—reinforced concrete.

11. Clay and clay products.

12. Abrasives.

13. Rubber—Natural and artificial—Plastics.

14. Paints—Varnishes—Lacquers.

(*a*) Glass—different varieties.

15. Glues and adhesives.

16. Insulators—Thermal and Electrical.

17. Road tars—bitumen—identification and test.

Text Book—Chemistry of Engineering Materials by K. B. Leighou MacGraw Hill—1942.

Practical Work.

1. Estimation of hardness of water.
2. Proximate analysis of coal.
3. Ultimate analysis of coal.
4. Calorific value of coal.
5. Calorific value of liquid fuel.
6. Gas calorimeter.
7. Gas analysis--G-set.
8. Tests and lubricating oils.
9. Gravimetric analysis of two alloys.
10. Estimation of SO_4 in Gypsum.
11. Estimation of CO_2 in lime stone.
12. Estimation of Quartz in clay.
13. Estimation of CaO, Al_2O_3 and Sio_2 in a sample of cement.
14. Preparation of a sample of steel for microscopic examination and its study with etching solutions.

Civil Engineering.

i. Building materials: Stone, Brick, tiles, characteristics, manufacture and uses.

ii. Lime, Cement, Mortars and Concretes—Properties, manufacture and uses.

iii. Timbers :-Chief Indian timbers and their characteristics—Causes of decay—seasoning and preservation, strength.

iv. Iron and Steel :—Standard sections and Types, Specifications—detection of flaws.

v. Paints and Varnishes :—Different kinds–preparations.

vi. Miscellaneous materials, other metals—non-metals—glasses and patent materials.

Field Engineering—collection and storage of materials–strength of cordage, chains, ropes, erection and use of derricks, gyns cranes etc-, knots and lashings.

Surveying

Chain Survey.—Methods of carrying out a chain survey—equipment—ranging and chaining line—errors in chaining—Methods of avoiding obstacles—the lines and check lines—off-set ;

cross-staff and optical square; the field book; scale of plan; methods of booking and plotting.

Compass surveying.—The prismatic compass, constructional details and its uses. Bearing and angles. Magnetic and true meridian—Variation. Declination—Local attraction—elimination of effects—sources of error—limits of precision—adjustment of closing error—methods of booking and plotting.

Plane-table Survey:—Equipment—setting and use of plane-table. Alidades—simple and prismatic—Resection—two point and three point problems.

English Composition

Preparation of reports etc.

Geometrical Drawing

1. *Practical Plane Geometry*:—Construction and use of scales; Areas of plane figures, methods of drawing ellipse, parabola, hyperbola, cycloidal and involute curves and helix.

2. *Practical Solid Geometry*:—Projections of points; lines and planes. Projections of simple solids, prisms, pyramids, cylinders and cones. Auxiliary projections, Sections of Solids; development of plane and curved surfaces, interpenetration of solids, cylinders, cylinders and cones, prisms and pyramids. Isometric projection and elements of perspective.

INTERMEDIATE (ENGINEERING) EXAMINATION PART II

Mathematics

Pure Mathematics:—Standard integrals, methods of integration, the integral as the limit of a sum, determination of areas, volumes, surfaces, centres of gravity, and moments of inertia 'Pappus' theorems, the line integral, theory of the planimeter, double and triple integrals.

The analytical geometry of the line, plane, sphere and cone, the helix, projecting planes of a line, projecting cylinders of a curve.

Applied Mathematics:—Forces in 3 dimensions, equilibrium of a body under forces in 3 dimensions in the simplest cases. Instantaneous centre, body and space centrodes, moments and products of inertia, kinetic energy of a body rotating about a fixed axis, compound pendulum, motion of a rigid body (two dimensional).

Hydrostatics:—Transmission of fluid pressure, thrust of fluid on a plane and on curved surfaces, centre of pressure, conditions of equilibrium of floating bodies, Metacentre, stability of a floating

body, pressure of the atmosphere, Boyle's law, simple hydrostatic machines, work done by the expansion of a gas.

Applied Mechanics

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

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

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

Thin cylinders.—Stresses and strains in thin cylinders subject to uniform internal pressure or both.

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

Distribution of shear stresses in a beam section.

Civil Engineering

Foundations.—Determination of bearing capacity of soils—excavation, strutting, underpinning, method of increasing bearing capacity—ordinary foundations such as masonry footings-grillage and pile foundations and simple calculations pertaining thereto.

Plain masonry and brick work—Common bonds in use and methods of laying; coursed and uncoursed rubble ashlar, coping, cornice and string course; finishing and pointing; damp—proof construction; anchorages in walls; fire resisting construction for flues; chimneys and fire place; dressings such as door jambs and door and window sills; flat segmental pointed and elliptical relieving arches—centering for arches and striking of centres; vaults and domes.

Floors and roofs—Floor 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, ceilings and constructional details.

Carpentry and joinery—Usual kinds of joints in timber; doors, windows and ventilators; partitions, scaffolding and false-work; simple roof and bridge frames.

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

Columns—Details and methods of construction in brick, stone, steel and concrete.

Scaffolding—Materials used and principles of erection and maintenance.

Hoisting appliances—Construction and maintenance.

Safety measures—Organization and supervision—safety regulations.

Estimating

In elementary form.

Field Engineering

Setting out of works and ground tracing.—Practical building work—inspection and report.

Mechanical Engineering

The boiler: Usual common types; function of the principal parts; Solid, liquid and gaseous fuels suitable for steam raising. Calorific values, cumbustion and draught.

The Steam Engine:—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—principle underlying expansion in stages. Arrangements of cylinders for compound engines. General ideas regarding Meyers, Trip, and Corliss, valve gear. Lubrication, Jacketing of cylinders.

The Steam Turbine: Parsons and Delaval steam turbine. Internal cumbustion engines; four-stroke and two-stroke cycle engines; high speed and slow speed. Low compression, high compression and Diesel Engines. Fuels for I. C. engines and their relation to speed and compression. Carburetters. Fuel pumps, magnetos; coil ignition, vapourisers, Lubricating and cooling of cylinder. The suction gas engine; sketch, working and names of the principal parts of the gas plant, fuel for the gas plant.

Testing of Engines; Indicators and Indicator diagrams; Indicated H. P. Brake Horse Power; fuel consumption; mechanical and thermal efficiencies; Simple problems.

Transmission of power: Gear drive, belt drive, rope drive and chain drive; velocity ratio. Simple problems.

Manufacturing methods and workshop practice;

General ideas of forging, casting, machining and fitting. Simple illustrations of the complete manufacture of a machine part or engine embodying the above. Elementary ideas of a lathe, shaping, planing and drilling and milling machines and kind of work turned out by each machine.

A brief summary of the materials used in machine construction. C. Iron, M. steel, W. Iron, Carbon steel and alloy steels, copper and its alloys, aluminium and its alloys.

Electrical Engineering

1. Electrical circuit; Practical system of electrical units, conductors and insulators. Specific resistance; temperature coefficient. Series and parallel grouping of resistances Kirehoff's circuit laws and applications.

2. Electro-magnetism; magnetising force, magnetic induction, permeability. B. H. curve and its determination. Hysteresis and determination of hysteresis laws. Calculations of simple magnetic circuits. Lifting power of electro-magnets.

3. D. C. Machines. Component parts of a dynamo and their functions. Magnetisation curve. Self excitation and voltage drop on load of shunt generator. Characteristics 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 regulator.

4. Alternative Currents: Production of alternating voltage Wave form. frequency and amplitude. R. M. S, Value, average value. Form factor for sinusoidal alternating currents and voltages. Inductance, reactance and impedance Power and Power factor. Solution of simple series and parallel circuits. Elementary knowledge of three-phase currents.

5. A. C. Machines. Elementary knowledge of the principles and applications of the transformer, alternator, synchronous motor and induction motor.

6. Measuring instruments; working principles and uses of moving Iron and moving coil ammeters and voltmeters. 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 wires and three wires D. C. systems A. C. single-phase; three-phase, three wire and four wire systems. House wiring and accessories: testing of faults in house wiring.

Surveying

Levelling: Different types of levels and their construction and details; use and adjustments of level; Staves-Fly levels—

spot levels, longitudinal and cross sectional levelling, reciprocal levelling. Contouring on land and water. Hill contouring—Ghat roads—barometric heights—Field books—methods of booking and plotting—allowable errors—clinometers.

Earthwork and capacity of Reservoirs—By contour lines and cross-section levelling.

Theodolite—Traversing and laying out curves.

(Students will go on survey camp for 2 weeks)

Building Drawing

1. Detailed drawing of building parts as dealt with in building construction course.—Drawing from sketches and specification such as residences, offices etc.

2. Working of small buildings from sketches and specifications together with simple design calculations.

Machine Drawing

1. Copying accurately to scale drawings of simple machine—details such as bolts, nuts, keys, cotters, rivets, and riveted joints, pipes and pipe-joints, bearings, hangers, pedestals, wall fixings, etc.

2. Drawings of simple machine and engine parts from sketches. Ability to supply additional views and to give some idea of the proportions of simple machine parts.

B. E. DEGREE EXAMINATION

Part I

Mathematics

(*Common to civil, Mechanical and Electrical*)

Formation of differential equations, equations with variables separable. Differential equations of the first order and of the first degree, linear equations with constant coefficients, simple partial differential equations conneeted with engineering problems, Fourier series.

Approximate differentiation and integration, numerical solution of differential equations, graphical solution of eqution, Newton's method, Horner's process for solving equations, fitting of empirical equations to observed data, use of logarithmic, triangular and other special types of graph paper, interpolation harmonic analysis.

Strength of Materials and Theory of Structures

(Common to Civil, Mechanical and Electrical)

Compound stresses and strains—Stresses under combine, strains, principal stresses and principal planes; ellipse of stress; Mohr's circle. Application to different cases.

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

Circular Shaft—Theory of pure torsion, shear, stress, angle twist, strength and resilence; horse-power transmission combined torsion and bending with or without end thrust; determination of principal stresses and maximum shear stresses: equivalent bending moments and equivalent twisting moments.

Helical Springs—Extension under axial pull and maximum shear stress--angle of twist and torsion and maximum direct stress strength and resilence.

Thick Shells and Cylinders—Stresses under internal and external pressures.

Deflection of frames—Catigliano's Theorem I. Resilience due to bending moment, shear and torsion.

Continuous beams and propped cantilevers—Theorem of three moments calculation and graphical determination of reactions bending moments, shear force, deflection and slope—Moment distribution methods.

Masonry Works, General conditions in stability—Middle third rule—lines of resistance—distribution of pressure intensities elementary principles of design of masonry dams, gravity section.

Hydraulics *(Civil, Mechanical and Electrical)*

Fluids in motion—ideal fluid—steady and unsteady motion—stream line—Bernoulli's theorem—applications—venturi meter—vortex motion.

Orifices and notches—small orifices—large orifices—drowned and partially drowned orifices—mouth pieces—time of discharge—weir; rectangular, triangular, trapezoidal, velocity of approach: drowned weirs, height of sill, nappe and its stability—flat crested weirs,—gauging of weirs and anicuts—bridge opening—sluices—Siphon spillways.

Pipes—Laws of fluid friction. Loss of head and hydraulic gradient—straight and circular pipes of uniform diameter and hydraulic mean depth. Critical volocity. Empirical formulae. Chezy : D'Arcy, Kuttur and Logarithmic formulae—bends—elbows—valves—variation of velocity in cross section variable diameter—syphons, hammer action. Viscous flow. Transmission of power through pipes, nozzles—multiple flow.

Flow through channel.—Elementary.

Structural Engineering (*Civil*)

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

(ii) *Masonry*–Retaining wall and dams, 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 retaiaing walls and gravity and arched masonry dams.

(iii) *Bridges and culverts*—Data of 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 abutments ; detailed design of arched bridges and culverts, specifications, empirical rule.

(iv) *Reinforced Concrete*—General principles ; Theory and design of rectangular beams ; tee-beams, slabs and columns ; arrangements of laying reinforcement ; leading system of reinforcement ; economical methods of construction design and details of formwork.

(v) *Structural Steel Work.* Beams and Girders : Properties of British Standard sections ; detailed design of beam ; compound girders, build-up plate girders and lattice girders—girders types and typical details of construction.

(vi) *Columns and Struts*—Plain and built-up sections ; assumptions regarding end conditions ; practical formulae for design ; design and details of caps, bases and brackets for stanchions ; lacing on stanchions.

(vii) *Roof trusses*—Roof trusses, detailed design of members including purlins joints and connections.

Geology (*Civil*)

Petrography—Igneous, sedimentary and metamorphic rocks—classification of igneous rocks. Sedimentary rocks and more important metamorphics.

Structural Geology—Stratification, dip, strike, outcrop folds, faults, etc.

Civil Engineering Geology—Building stones and materials, underground water circulation and artesian wells. Abrasives—asbestos, chalk, clays—refractories.

Lab works—identification of works and rock forming minerals etc.

Communication Engineering (Civil)

Railway Engineering—Permanent ways ; gauges Indian Railways ; plate laying and maintenance—points and crossings—Details and formulae and practical rules—super-elevation creep of rails, ruling gradient—compensation—track resistance, tractive effort—important stations. Station yards—general knowledge about signalling and interlocking—level crossings in mountain Railways.

Tunnels and their alignments and methods of construction.

Highway Engineering.—Classification of roads—estimation traffic—availability of materials and choice of type of roads—tests of materials—gradient camber : road foundation and underdrainage—road surfaces—water bound macadam—tar sprayed macadam—tar macadam hot and cold emulsions—bituminous carpets, stone paving, wood-block paving—asphalt roads—plain and re-inforced concrete roads—standard specification; resistance to motion of vehicles and influence of various road surfaces—estimation of draft—machinery employed—latest advances in highway engineering. Arboriculture.

Surveying (*Civil*)

Surveying.—Advanced and precise levelling-contours-grade-contours—stadia and their use. Sources of error ; precautions, accuracy required ; correction for curvature and refraction ; dip of the horizon.

Tacheometry.—Stadia. Triangulation—Base line measurement—accuracy—corrections—required—field observations—satellite stations—3 point problem.

The theodolite : types of instrument ; parts of the instruments and their uses. Handling and care of instruments ; temporary and permanent adjustment.

Laying out curves with and without theodolites ; determination of heights. Use of planimeters ; finding areas by various methods—use of instruments such as sextants, barometers etc.

(Students will go on survey camps for 2 weeks.)

Quantity Surveying *(Estimating)*

Taking out details and working out quantities from given specifications and drawings pertaining to buildings and bridges—working out cost of terms supported by detailed data—abstract estimate—supervision and contingent charges.

Design Drawing *(Civil)*

Designing and detailing important types of buildings, and culvert in plain masonry or timber.

Designing and detailing steel work for steel-framed buildings, plate and lattice girder bridges(road or railways)

Designing and detailing reinforced concrete buildings, highway bridges, retaining walls.

Structural Engineering. *(Mechanical and Electrical)*

Syllabus as per items v, vi and vii of Structural Engineering *(Civil)*

Automobile Engineering *(Mechanical)*

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.

Crank shaft :—Construction, balancing and vibration dampers.

Clutch :—Hele-shaw, multiple dry and single plate dry.

Fly-wheel :—Ordinary and fluid.

Carburettor :—Ordinary and down draught.

Ignition :—Magnets and Coil.

Petrol feed :—Gravity, vacuum, diaphragm and electric pump.

Gear box :—Clash type, constant mesh, synchro mesh and preselective. Hydraulic and other gearless transmission.

Transmission :—Cardan shaft; universal joints, crown and bevel, worm gearing and chain.

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 repair.

High speed Diesel Engines used for automobile work.

Heat Engines : *(Common to E. & M.)*

Thermodynamical principles—laws of perfect gases–Entropy diagrams—hot air engines—cycles of operation—Carnot's cycles-conditions for maximum efficiency—dual combustion cycles, internal combustion engine—petrol, gas and oil engines—constant pressure-constant volume cycles—effects of compression-indicator diagrams-efficiencies—engine testing.

Air Compressors.—Theory of air compressors and motors—single and multi-stage compressors—efficiency—Intercooling.

Mechanical refrigeration.—Properties of vapour ammonia carbon-dioxide—sulphur dioxide—choice of a refrigerating agent-Co-efficient of performance—types of vapour compression machines—horse power required—design and erection of cold storage rooms and refrigerating plants.

Electrical Technnology *(Mechanical)*

General principles.—Electric and Magnetic laws, units and Standards. Electric and magnetic properties of materials—electric and magnetic circuits. Magnetic Measurements of permeability and hysteresis.

Measurements.—The principles and constructions, 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, sees and compound types : construction working, and simple theory—types of windings ; lap and wave. E. M. F equation. Armature reaction—tests by direct and indirect methods. Parallel operation and sharing of loads 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 polyphase currents.

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

Machine Drawing and Design

To cover syllabus under structural engineering, automobile engineering & heat engines.

Electrical

Theory and Calculation of Electrical Apparatus

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. Tirril and other voltage regulators. 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 characteristics of shunt, series and compound motors. Swinburne's tests. Testing pairs of similar series and shunt motors.

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 constructions. 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-transformer; comparison with double wound transformers, Instrument transformers.

Polyphase currents and circuits.

Polyphase transformers—Types and construction. Three phase connections. Third harmonic in phase voltage. Tertiary winding. Auto-transformers. Transformation from three phase to single phase, two phase, six phase and twelve phase. Paralleling and parallel operation. No-load and on-load tap changing. Induction and moving coil voltage regulators.

Design and Drawing (*Electrical*)

D. C. Machines.—Magnetic and specific electric loading-Output coefficient. Effect of number of poles on general design. Ration 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-cap.

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. Reinforced coils. Magnetising current Cooling. Losses. Calculation of efficiency and regulation.

Workshop—soldering, cable jointing, armature winding and electrical welding.

B. E. DEGREE EXAMINATION

Part II

Fourth Year (Civil)

Theory of structures

Theories of earth pressures—geographical constructions—retaining walls—Rankine's theory applied to foundations.

Moving loads and influence lines.

Curve of maximum bending moments and maximum sheer 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 spandril-braced arches; reversal of stress under live load.

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 locii; lines of resistance through rigid and hinged arches under dead and live loading.

Structural Frames.—Calculation and graphical determination of forces in members of roof trusses with knee-braced girders of variable depth with or without secondary members and trestles; displacement diagrams for braced girders; analysis of simple types of indeterminate frames—portal and away frames.

Structural Engineering

Reinforced Concrete-bridges.—Detailed design of different types of highway bridges.

Tanks and towers.—General principles of design; methods and details of construction, detailed design of low and high tanks from specification. Recent advances in reinforced concrete construction and in methods of calculation vibrated concrete.

Prestressing—mechanical methods of stress analysis. Column analogy methods.

Retaining walls.—Cantilever and Counterfort types; their detailed design from specifications, methods and details of construction.

Miscellaneous structures.—General principles relating to the design and construction, of bunkers, gantries, domes, jetties, pile and raft foundations steel work—Bridge work. Detailed design of highway and railway bridges of plate and lattice girder types. Different types of floors, transverse and lateral braces and bearings; important considerations and general principles relating to design of cantilever, suspension, swing, left and bascule bridges.

Miscellaneous Structures.—General principles relating to the design of tanks and towers, structural parts of cranes, tall chimneys bunkers, domes, jetties, pipe lines etc.

Timber.—General principles of design in timber with special reference to structures, such as roof trusses, beams and columns, bridges, trestles and form-work for reinforced concrete structures.

Erection.—General methods of erection of building and bridges.

Hydraulics and Hydraulic Machinery (*Civil*)

Channels.—Variety of forms—steady motion in uniform channels, Formulate; D'Arcy. Bazin, Kuttur, Logarithmic; variation of velocity in cross section—measurement of discharges—sections of aqueducts and sewers—best form of channels—non-uniform flow—backwater. Standing wave, Lacey's Theory for regime of channels—Khosala's theory for design of weirs.

Measurement of flows. discharges.—Pipes, meters-Pitot tube—chemical method-channels weirs formulæ, floats—Ripple method—Gauges—current meters.

Impact.—Pressure on fixed and movable vanes-Work done.

Water Wheels.—Turbines; Piston engines.

Pumps.—Reciprocating; centrifugal-Hand-Ram-Airlift, etc.

Sanitary Engineering (Civil)

(i) **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, quantity. Tube wells.

Rivers.—Trenches, infiltration gallery. Intake wells.

Storage reservoirs.—Site, capacity, compensation water dams, waste weirs, outlet, conduits, valve tower.

Conveyance.—Pipe lines, hydraulic gradient, types of aque, ducts, syphons, air valves, balancing reservoirs.

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

Pipes and Pumping.-Pumps and suitability, pumping station pipe fittings and appurtenances.

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

Slow filtration.—Filter beds: area, size arrangement of sand-layers, materials and construction, rate of flow, regulation cleaning.

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

Sterilization.—By chlorine, light, electricity, etc.

Softening.—Hardness in water, method 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, valves etc.

Waste detection and prevention. Meters.

(ii) **Sewerage and sewage disposal**

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

Trade Effluents.—Their treatment.

Drainage and Sewerage.—Rainfall, house drains, surface drains, under ground 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.—Composition of sewage. Disposal on land, sewage sludge utilisation as manure, disposal in the sea.

Bacterial purification.—Contact beds, intermittent sand filtration, precipitation, septic tanks, trickling filters, sludge disposal of sludges, activated sludge, design of disposal works.

Public Utilities

(iii) (Water works, sewerage and sewage disposal.)

Selection of sites, orientation of buildings, ventilation, lighting and air conditioning Hospitals, libraries, fire stations, schools, markets, burial and burning grounds, slaughter houses, public baths, parks and playgrounds, theatres and cinema halls A. R. P. shelters etc.

Irrigation, Docks, and Harbours

(i) Irrigation Engineering

General.—Importance of irrigation works; productive and protective works—general principles of flow, life perennial basin or inundation and well irrigation; principal crops, duty, factors affecting duty for crops under storage and direct flow irrigation, duty in Madras systems. Rainfall and run-off; study of rainfall statistics utility in run-off calculations, flood discharge and its estimation, Percolation, evaporation and absorption loses in canal and storage systems, Uplift in piping; stability of work affected by percolation. Silt analysis; silting of reservoirs; flow in canals, Kenndy's critical velocity and its applications.

Diversion works.— General description of rivers, river weirs; selection of sites; types on permeable and impermeable soils weir erest shutters; principles governing the design and construction of river regulators, undersluices, flood banks, and protective works. Retrogression of levels.

Storage works.—Selection of; masonry dams; principles of—design of gravity, arch and other types; uplift in masonry dams; drainage galleries; expansion joints; methods of construction. Earthern dams; causes of failures; types of dams; materials for dams, methods of construction, drainage and properties, puddling, consolidating, dressing and turfing etc., and foundations.

Component Works—sluices surplus escapes; ordinary types, stepped waste weirs, syphon spillways. Selection of sites—tanks—isolated and rainfed, single or in groups, supply, capacity, repairs to bunds and breaches. Flood absorptive capacity of reservoirs; formulae for design of weirs.

Distribution System:—Design and alignment of canals, distributories etc. In deltaic and non-deltaic countries—capacity command, limiting velocity etc. Drainage, necessity water logging, alkalinity of soils, drainage, principles in design of drainage channels; outfalls, lining of canals. General description, construction and design of masonry works of canals (a) for regulation of water levels; rapids, falls or drops, notches, escapes, syphon well drops, sluices; modules (b) cross drainage works and surplus works, aqueducts, syphon aqueducts, super passages, level crossings, inlets and outlets; (c) communication works, road dams, fords etc.

Navigation canals.—Main features; locks, desirability of combining navigation and irrigation.

River training works.—Spurs, groynes, bells, bunds, mattresses, sprons etc. Soil—studies—properties—stability—erosion—prevention. Preventing malaria incidental to engineering works.

(ii) (Docks aud Harbour Engineering)

Physical geography in relation to docks and harbours; natural phenomena, prevalence and intensity of winds, coastal changes; accretion and denudation; effect of artificial interference; tidal phenomena: waves from; height and length wave velocity and wave action.

Objects of docks and harbours; consideration effecting choice of site; entrance to docks and harbours, fore-shore protection and channel regulation: wet, dry and floating docks; tidal basins and harbour, different forms and types; detail and methods of construction, lock gates; their construction and working, machinery employed. Different types of quay walls, their construction and maintenance; signals and light houses, ferries and landing piers, description of important existing docks and harbours. Latest advancement in dock and harbour engineering.

Hydro Electric Engineering

(Common to C. M. & E.)

Preliminary investigation and report—Possibilities of economic developments—possibilities of load.

Rainfall—Evaporation from water and land surfaces—Run off—seepage—Estimation of steem flow—Gauging. Sounding and meter observation. Flood flows. Available power without storage. Storage and pondage. Storage and diagrams. Mass duration and time curves—Flow over dams and rivers. Discharge through sluice gates. Eddy losses and loss of head. Water hammering.

Choice of site—available head—Market requirements. Possible flow regulation. Alternative schemes of development. Reconnaisance load surveys and preparation of project Reports.

Dams.—Types and descriptions — stability calculations. Spillways—expansion joints—Rolling gates, Drainage gates. Intakes, headgates and valves. Canals, flumes, tunnels, conduits, pipe lines, air valves, relief valves, and surge tanks.

General layout and design of power stations.—Turbines—general types, application and constructional details Characteristic curves. Specific speeds and speed regulation,Choice of turbines

Generators and transformers, Generator—and Transformer fire protection. Temperature detectors. Fire protection—Station wiring and lighting—auxiliary power plant—Switch-gear layout.

Economics of hydro electric development—Limiting capital cost of H. E. plant—operating expenses—Cost of Hydro-electric installation. Interconnection of steam and hydroplants—stand-by service.

Geodesy (Surveying) *Civil*

Tunnel surveying—mine surveying—instruments and method of using them.

Hydrographical surveying—Tides and tide guages—sounding—shoreline surveys.

Photo-theodolite—photographic surveying-geodetic and astronomical surveying—spherical trigonometry—and simple formulae—astronomical terms and explanations—altitude—azimuth—right ascension—declination—hour angle—siderial and mean time—meridian latitude—longitude observations for their determination.

Latest instruments.

Nautical almanac.

Design and Drawing (*Civil*)

Designing and detailing important types of (i) irrigation works such as tank surplus weirs, regulators, drops, siphon, aqueducts, superpassages, locks etc. (ii) Sanitary engineering works. (Water supply, sewage disposal etc ,) and (iii) tanks and towers of R. C. and steel.

Project

Project.—4 weeks duration—(details given under regulations cf. page 6)

Quantity Surveying

Estimating—Detailing of quantities and working out costs of irrigation works.

Engineering economics.—Principles of organisation and working of banks. Other financial institutions—industries etc.—Principles of manufacture—division of labour—human factor.

Accounts—Book Keeping—Cash book—Ledger—Workman's Compensation Act—Settlement of disputes etc.

Accounts for execution of Civil works.—Stocks of stores—Tools and plants—Other materials—Suspense and manufacture accounts—Muster roll—Measurements of materials used—Measurement book.

Contracts.—Tenders—estimates.

Administration.—Financial and Technical sanction—Regularisation by works slip—deviation statement—Revised estimate Permanent advance—contingent bill—imprest work ledger—work abstract—work register—schedule of costs—completion reports.

Heat Engines (Mechanical and Electrical)

Properties of steam, wet, dry and superheated—Total heat external work done—internal energy—entropy of steam—related diagrams.

Steam Engines.—Expansive working of steam-Rankine's cycle—efficiency-losses in actual engine due to wire-drawing-steam jacketing—methods of reducing losses-advantages of compounding and multiple expansion. Indicator card and diagram factor—engine trials.

Turbines.—Flow of steam through nozzle—velocity at throat and exit of nozzle—nozzle design—effect of friction—supersaturated flow—impulse turbine—velocity diagrams—blade friction—compounding of impulse turbines—velocity compounded and pressure compounded turbines—reaction turbines—Parson's Junestron and other types—Velocity diagrams—Design of blades and drums—factors affecting efficiency.

Engine details.—Cylinders, pistons, camshaft valves, piston rods, stuffing box gland and packing, connecting rods, crosshead and guides, Crankshaft bearings and bed plate. Fuel injection—ignition Governors. Condensers and pumps. Lubrication and jacketing of cylinders.

Valves and valve gears.—For Stationary and locomotive steam engines; D. Side valve; Meyer's expansion valve; link motions and radial gears. Corliss valves; drop valves and trip gears; valves for internal combustion engines, air compressors and refrigerating machines; diagrams and flywheel calculations.

Electrical Technology (Mechanical)

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

A. C. Motors.—Synchronous motor, construction working and simple theory; current locus at constant voltage excitation, variation of current and power factor with

changing excitation ; hunting and prevention. Polyphase induction motors squirrel case and slip ring types ; simple theory working and construction ; rotating field : direct and indirect tests on performance ; the circle diagram ; methods of starting. Simple theory and operating features of the single phase induction motors, series motors and charge motors.

Motor converter.—Simple theory and operating feature.

Measurements.—The principle of construction, use and calibration of A. C. instruments ordinarily employed. The Duddell Oscillograph. The synchroscope. Single phase power factormeter.

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

Theory of Machines

(*Mechanical*)

Kinematics and pure mechanism.—Definition of a machine, machine elements, links, chains and mechanisms.

Constrained motion.—Translation and rotation ; instantaneous centres ; velocity and acceleration diagrams, inversion of mechanisms. Quick return motion, cylinder crank chain.

Transmission of power.-Wheel trains, simple, compound and epicyclic, Chain belt and rope drives

Friction of rest and motion.—Screw threads, thrust bearing, clutches and brakes, worm gear and cams. Properties of lubricants—types of lubricants—tests—types of lubricators.

Reciprocating Engine.—Velocity and acceleration of piston and connecting rod, Inertia effects, turning moment diagram, flywheel. Balancing of Engines, primary and secondary effects, Governors.

Gyrostatic action—torsional oscillations—vibrations, forced, viscous ; damping—Rotating discs.

Hydraulics and Hydraulic Machinery

(*Mechanical and Electrical*)

Water wheels and turbines.—The action of a jet upon vanes, whether at rest or in motion ; straight or curved—

waterwheels—theory design and efficiency—turbines—theory design and speed regulation—general features of a hydro electric plant.

Pumps.—Bucket and plunger ; pistons, valves ; air vessels and stand pipes ; efficiency of Pumps. Centrifugal, and turbine pumps, multi-stage pumps—pulsometer—rams air-lift pumps ; gas pump etc.

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

Fuels, Gas Plants and Boilers

(*Mechanical*)

Fuels and Gasplants

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 anthrasite varities of coal. Production of coke. Indian coals, distillation of wood and production of charcoal with special reference to India.

Minor solid fuels :—Bagasse, spent and tan Nile Sud, straw, paddy husk, cocoanut fibre etc., pulverised 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, shaleoil, tar and tar oils. General characteristics and distillates obtained from above. Physical characteristics, chemical composition, calorific value and fuel consumption. Standard laboratory tests. Power, alcohol, and synthetic fuel.

Liquid fuels for steam raising purposes, general arrangement of air, steam and pressure systems. Relative efficiencies, burners for above.

Gaseous fuels :—Natural gas, oil gas, town gas, coke oven gas and blast furnace gas, Physical characteristics, chemical composition, calorific value and fuel consumption. General ideas about the preparation of the gas. Suction gas plant. General layout and working for bituminous and non-bituminous fuels.

Problems on calorific value and consumption,

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 boiler.

Boiler details :—Riveted joints, longitudinal and circumferential seams, End plate connections. Flues, Fox, Morrison, Deighton and suspended bull corrugations, Man holes and hand holes. Caulking and fullering. Stays, Gusset, bolt, tube, stud girder and sling.

Boiler Accessories :—Economiser, super heater, 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 blowout valve.

Boiler Draught :–Natural, artificial, forced, induced, balanced. Howdens, Ellis, and Eaves and closed stoke hold system.

Mechanical Stokers :—Coking, 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 Rivetors. B. O, T. and Lloyds specifications. Hydraulic and steam tests.

Problems :–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_2.

Hydro Electric Engineering (*Mechanical*) Same as Civil

Machine tools and Workshop Practice
(*Mechanical*)

Smithy :—Blacksmith tools, fullers, swages, tongs etc. Arrangement of fires, pressure fans for blast. Suction fans and prevention of smoke. Swaging, fullering, upsetting and welding. Examples of light and heavy forging. Power hammers. Steam, pneumatic and drop hammer, examples of drop forging and mass production.

Foundry :—

Iron Foundry (a) *Pattern making* :—Principles underlying the making of patterns and core boxes. Metal patterns for mass production.

(b) *Moulding* ;—Moulder's tools, trowels, cleaners etc. Examples of moulding machine parts.

(c) *Core making* :—Various methods of making cores, special cores for pipes and cylinders.

(d) *Moulding Sand* :—Selection and preparation of moulding sand. Grades of moulding sand. Green and dry sand moulding. Simple examples.

(e) *Cupola* :—Dimension, lining, method of starting, Charging and drawing of the metal. Preperation of the mould for casting.

Brass Foundry :—Moulds for brass and bronze machine parts. Crucibles, ordinary and tilting. Melting, mixing and casting. Die casting and mass production.

Moulding Machines :—Pressure, tilting, vibrator and centrifugal moulding machines.

Metallurgy :—Definitions and explanations of terms used in metallurgy. Metals of importance to the engineer. Elementary metallurgy, C. I., W. I., M. S , carbon and alloy steels. Method of manufacture and heat treatment Malleable casting.

Normalizing, annealing, hardening tempering, case hardening and Nitriding useful alloys of copper and aluminium. The use of zinc, tin, lead, nickel, manganese chromium, tungsten, vandium etc,

Fitting Shop .—Fitters tools, hammer, chisel, file, scraper, stock and dies etc. Marking table and accessories. The marking out work chipping and filing and scraping examples.

Limits, tolerance and allowance. Newalls and B. S. specifications.

Classifications of work. Interchange ability of parts and mass production.

Machine Shop :—

Lathes :—Specifications, parts and description. Classification; bench, engineer's heavy duty and special lathes. Modern improvements, automatic feeds. Jigs tools and accessories. Examples of screw cutting and other work. Capstan and turret lathes. Mass production.

Shaping Machine :—Specifications, parts and descriptions, modern improvements automatic feeds. Jigs tools and accessories. Examples of work.

Planing Machine :—Specification, parts and description. Modern improvements. Automatic feeds. Jigs, tools and accessories. Drive, gear, belt, electric, epicyclic train and chain. Examples of work.

Drilling Machine :—Fixed spindle, radial and universal specifications, parts and description. Modern improvements. Automatic feed. Jigs, drill and accessories, Example of work. Gang drills.

Milling Machine :—Vertical, horizontal and universal. Specification, parts and description. Jigs, tools and accessories. Examples of work. Milling surfaces, slotting, key way cutting slitting and straddling. Machining bevel gears, worm gears, spur gears, helical gears and cams.

Gear Shaping Machine :—Specifications parts and description, Modern Improvements. Automatic feeds. Jigs, tools and accessories. Machining spur, worm, bevel and helical gears. Rocks cutters and holes.

Grinding Machine ;—Horizontal and vertical. Surface, cylindrical, taper and internal grinding. Specification parts and description. Modern improvements. Automatic feeds.

Grinding wheel. grit, grade manufacture, pripheral speed, side feed and depth of cut. Accuracy and finish of work. Examples of work.

Boring machine :-Horizontal and vertical, specification, parts and description. Modern improvements. Jigs tools and accessories. Examples of work

Tool room.—The necessity of tool room in a workshop. Mass production of standard tools. Carbon, high carbon high speed. Widia and diamond tools. Heat treatment ; hardening, tempering and annealing. Furnaces, pyrometers and charts. Salt baths, quenching baths and air blast. Grinding and sharpening of tools. Emery grinders, twist drill grinders. Milling cutter grinders and Lumsden oscilating tool grinder.

Measuring Instruments.—Whitworth measuring machine, Micro-meters, internal and external, micrometer and vernier callipers, two-point and four-point gear tooth vernier.

Engineering Economics (Mechanical)

Engineering Economics -Business organization, advertising, insurance, stores, costs and costing, depreciation and valuation. Labour and wages, methods of paying wages, bonus aud profit sharing systems. Trade Unions, Strikes and Lockouts—Stores management.

Book-keeping.—The Journal, cash book, purchases book, sales book, the ledger, double entry, balancing, trial balance, balance sheet, bad debts. The trading and profit and loss accounts.

Specifications.—Specifications for inviting tenders. Information to be given on preliminary enquiry and on placing the orders, contracts for supply, erecting, guarantees and acceptance. Standard forms of contracts.

Estimating.—Estimating cost of simple machines, steel framed structures. elevated tanks, cost of shops with shafting, counter shafting, beltings, pulleys etc.

Law—Industrial legislation. Workman's Compensation Act. Prevention and settlement of disputes—Unemployment Insurance—Health Insurance—Indian factory act.

Machine Drawing and Design.
(*Mechanical*)

Machine designs—Preparation of detailed working drawings of machinary and plant from given specification and from students' own design.

Electrical Theory and Measurements (*Electrical*).

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.

Alternating Current Theory.—Symbolic vector methods and 'complex' quantities and their application to practical cases *i.e.* Polyphase circuits and alternating current net works. Inversion and application to simple circuits. Harmonics in single and Polyphase circuits. Properties of rotating fields. Simple cases of transcient 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 Wheat stone, the Carey, Foster and the Kelvin bridge. Measurement of high and low resistance and reactance ; the Schering bridge and Heaviside Camp bell bridge. Frequency measurement. Oscilographs for high and low frequencies, Measurement of magnetic properties of iron. Iron loss measurement 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, dynamo-Meter and induction types. Energy meters. Ohm meters. Megger Frequency meters. Power factor Meter. Reactive current ammeter and synchronoscope. Maximum demand indicator. Electrical pyrometers.

Theory and calculation of Electrical Apparatus *(electrical)*

Alternator.—Types and construction. Methods of producing sinusoidal voltage. Single and polyphase armature windings. Expression for induced voltage. Star and delta connections. 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. Synchronising and synchronoscopes. Synchronising torque. Parallel operation.

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

Single Phase Commutator Motors.—Theory of operation, construction, vector diagrams and characteristics of uncompensated and compensated series motors. Shunt and series commutating poles. Methods of starting. Comparison of A. C. and D. C. series motors. Theory of operation, construction and characteristics of repulsion motors.

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. Predetermination of performance. Induction generator. 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. Polyphase capacitor motor and charge motor.

Single Phase Induction Motors.—Resolution of single phase flux into two rotating fluxes. Operation. Theory of operation, characteristics and starting of polyphase induction motor on single phase. Phase converter, Theory of operation

and characteristics of split phase, capacitor and repulsion—start induction motors and repulsion—induction motor.

Rotary Converters.—Synchronous converter. Theory of operation. Voltage and current ratios. Wave form of current in various coils. Armature copper loss; efficiency. Theory of operation, starting and characteristics of motor-converter. Power transformed mechanically and electrically. Armature reaction and commutation, comparison with D. C. generator.

Motor converter: General arrangement.—Principle of action—construction speed, frequency power conversion starting efficiency—Three wire converters—converters for lighting load, truction load, Inverted converter—Comparison with R. C.

Rectifiers.—Mercury arc rectifier—Theory of operation. Transformer connections Characteristics Interphase transformer. 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.

Hydraulics and Hydraulic Machinery (Elec) same as Mech

Generation and Utilisation

Generation.

Fixed costs and working costs of generation. Straight line and sinking fund methods of depreciation. Maximum demand, load factor, diversity factor, and their influence on the cost of generation. Systems of tariffs. Choice of site of station. Choice of prime movers and number and size of units and switch gear. Combined steam and hydroplants. Interconnected stations.

Cooling systems for generators. Protection against fire Objects and methods of earthing the neutral. Protection relays. Excitation systems. Voltage control Switchgear. Short circuiting of generators. Current limiting reactors

Frequency changers—synchronous changers—starting, synchronizing. Induction changers—comparison between synchronous and induction changers—Semi synchronous changer.

Utilization

Electric Drive.—Comparison of electrical and mechanical drives. Individual, group and semi-group drives. 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.

Electric Traction. Direct current. Single-phase and three-phase system. Motor characteristics. Sub-stations. Line and track construction. Current collection. Manual and automatic controllers Locomotive, motor coach and multiple unit trains. Diesel electric traction. mechanics of train movement. Energy and speed-time calculations.

Illumination.—Filament and gaseous discharge lamps and their characteristic Shades and reflectors. Design of factory lighting and interior illumination of buildings. Parallel and series systems of street lighting.

Electric Furnaces, electric-chemistry and electrometallurgy.

Hydro Electrical Engineering (*electrical*) same as civil

Transmission and Distribution

Transmission system — Electrical and mechanical properties of conductors, Corona. Construction of high voltage under ground cables Potential stress, Losses and faults in cables Types and construction of 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 Petterson coil. Calculation of short circuits in transmission lines. Circuit breakers and protective relays. Lighting arrestors ; Transposition of lines. P. F. control.

Loading and strength of conductors.—Sags and stress in conductors with supports at same level. Effect of temperature variation. Sags and stress in conductors with support at different levels. The Thomas Chart and its use for sag and stress determination. Use of wooden poles, steel poles, steel towers, Design of Town and small distribution systems. Indian electricity Act and Rules and safety precautions.

Comparison of D C. two-wire and three-wire, A. C. single phase, two phase and three phase system of distribution. Primary and secondary distribution. Calculation of voltage drop, in conductors for concentrated and distributed loads.

Design and Drawing

Alternators—Low speed, medium speed and Turbo-alternators. Output co-efficient. Main dimensions. Stator

winding. Design of slot Design of field system. Essential features in the construction of the Stators and Rotors.

Induction Motor.—Calculation of the dimensions. Stator winding. Rotor slip-ring and squirrel cage, Magnetising current. Efficiency.

PROJECT

(Syllabus to cover schemes under electrical generation, distribution, etc.)

SYLLABUS FOR OVERSEER CLASS

(TWO YEARS' COURSE)

First Year

Mathematics

Computation.—Approximations—Limits of error—use of Logarithmic tables—Evaluation of formulæ—Use of squared paper—Interpolation—Graphical solution of simple problems.

Mensuration.—Area and perimeter of plane rectilinear figures—Area of ellipse, sector and segment of a circle. Length of circumference and area of circle–Areas and perimeters of similar figures—Area of irregular plane figure by mid-ordinate rule and Simpson's Rule. Surface and volume of Prism, Cylinder, pyramid, cone, sphere, ring, surface and volumes of frusta of prisms, pyramids, cones, and of sectors and segments of spheres, volume of prismoids.

Plane Trigonometry.—Measurement of angles in degrees and radians. Definition of trigonometrical ratios of an angle and graphical determination of their values. Setting out angles from values of sine, cosine, etc. Use of tables of sine, cosine etc., Solution of right-angled triangles by calculation and drawing. Simple applications to heights and distances.

Applied Mechanics

i. *Stress and strain.*–Tension and compression. Hooke's law. Modulus of elasticity. Elastic limit. Ultimate strength. Factor of safety and working stress.

ii. *Elementary statics.*— Parallelogram, triangle and polygon of forces. Easy graphical applications to ordinary frames. Wind pressure on roofs. Centre of gravity.

iii. *Elementary study of beams.*—Bonding moment and shearing force. Sections in steel, wood.

Building materials

i. *Elementary Geology* :—

ii. *Stone.*—Varieties—Quarrying—Blasting—Dressing.

iii. *Bricks and Tiles.*—Brick earth—Tempering, hand and machine moulding. Drying. Pressed bricks tiles.

Ordinary, patent and special Characteristics of good tiles and bricks.

iv. *Lime, cement mortar, concrete plaster.*—Sources and properties of lime. Burning, slaking, mortar mixing, cement, surki, concrete. Tests for limes and cements. Plastering, painting. White and colour washing.

v. *Timber.*—Seasoning and preservation of timber, Varieties of timber used in Southern India. Strength and weight of timber. Characteristics of good timber.

vi. *Paints and Varnishes.*—Ingredients of paints, lithargs turpentine, linseed oil. Mixing paint. Painting old and new work. Wood oil. Coaltar Varnish. Putty. Glazing.

Building construction

i. *Masonry.*—Coursed and uncoursed rubble bond in brick-work. Foundations and footings. Wall plates. Wood bricks and plugs. Openings and timber beams for door and windows. Corbelling.

ii. *Carpentry.*—Mortise and tenon joint. Fishing and scarling. Iron straps and belts. Simple roof and bridge frames. Detail of joints. Frames of timber and iron combined. Doors and windows.

iii. *Roofs and floors.*— Pitched roofs. Couples Trusses. Rafters, purlins and reepers. Roof covering Terrace roofs on, joists and beams. R. C beams and slates Floors of stone brick, tiles, cement concrete, timber and ashpalte, Simple forms of iron roofs.

iv. *Stairs.*—Different types.

Surveying

i. *Chain, compass and Plane table.*—Ordinary surveying with chain, compass and plane table. Inaccessible points obstructed lines. Use of optical square and cross staff.

ii. *Level.*—Manipulation and adjustment of level. Levelling. Contouring. Cross sections. Use of Abnry's level. elinometer and ghaut tracer.

Geometrical Drawing

Elementary problems dealing with lines, triangles, quadrilaterals, circles, polygons, method of drawing plane curves

parabola, ellipse, rectangular hyperbola. Lines, points and planes. Projection of simple solids. The simple regular solids. Sections of solids.

Sketching and MachineDrawing

i. *Free hand model drawing.*—Ornamental outline. Application of elementary perspective to model drawing of simple objects.

ii. *Machine Drawing.* Ability to copy accurately to scale and supply additional views. Drawings of simple machine parts from sketches and from measurements.

Building Drawing

The work will be based on the syllabuses in construction.

Quantity Surveying (*Estimating*)

Preparation of detailed estimate and abstract estimate supported by data for simple buildings.

Field Engineering

Ground tracing, strength of ropes, chains etc., erection and working of derricks, gyns, cranes etc., knots and lashings, scaffolding.

English Composition

Preparation of reports etc.

SECOND YEAR

Applied Mechanics

i. *Simple Shear.*— Examples of applications in ordinary application structures.

ii. *Strength of beams of timber Steel and R. C.*— Application of simple formulae.

iii. *Design.*—Easy applications of theory and the use of empirical formulae in the design of small bridges, arches and retaining walls.

iv. *R. C. Work.*—Elementary design.

v. *Principle of work.*—Graphic representation, simple applications to machines. Potential and kinetic energy. Power, Horse-power and Friction.

vi. *Specific Gravity.*—Weights of Materials.

Road and bridges

i. General principles of location, alignment and construction of roads—subsoil and drainage.

ii. Road resistance tractive effort and ruling gradients. Camber and metal roads, survey, construction of metal roads in plain and hilly country.

iii. Modern Road Construction. Camber and width of roads, Pavements for cities—Kinds of Roadway—Tar Bitumen asphalt—cement, concrete and methods of using them for road work. Specifications—Road rollers—modern appliances used for road making.

iv. Wear on roads. Influence of wheels, tyres, speed conditions of road surface.

v. Construction of culverts. causeways and bridges, Elementary principles relating to their designs.

vi. Earthwork and other details of railway permanent way.

Hydraulics and Irrigation

i. *Tanks and Channels.*—Pressure in surfaces. Flow through orifices, notches, pipes, channels. Supply from wells, tanks and rivers. Discharge from catchment areas, Construction of tank bunds, escapes and irrigation sluices. Use of simple formulae for the discharge of escape and sluices. Discharge of channels. Permissible limits of fall and velocity in channels. Laying out and construction of channels. Regulation of supply from head sluices.

ii. *Wells.*—Locating sites for wells—geology of water bearing strata—Yield of wells—Boring tools and Boring. Well sinking and steining. Pumps including deep well and bore hole pumps. Water lifts. Piccotah-Mhote. Persian wheel, wind-mills.

iii. *Rural Water supply*—Provision of safe water supply in rural area.

Surveying

Theodolite.—Elementary use and adjustment of theodolites traversing. Gale's system. Setting out straight lines and curves in the fields.

Topographical Drawing.—Conventional signs, map drawing—Representation of ground by contours. Sections on contoured plans. Location of dams, roads and railways on contoured plans, showing cuttings and embankments. Estimation of areas and volumes. (Students will go on survey, camp for 2 weeks.)

Quantity Surveying

Estimating :—Detailing of quantities and preparation of bills of cost—supported by detailed data for the high-way and irrigation works.

Use and maintenance of records like Muster Rolls—Stock registers—Measurement book—work registers etc.

Preparation of workslip—deviation statement—Revised estimates—Completion report—tenders—contracts.

Elementary Mechanical Engineering

Fastenings:—Bolts, nuts, keys and cotters, riveted joints and connections generally, pipes and cylinders.

Transmision of Motion and Power.—Shafts, couplings, clutches, pedestals, and wall fixings. Belts, ropes, and pulleys. Toothed gearing, spur and bevel wheels, rack and pinion, worm gearing, cams. Examples and uses of above in ordinary machines.

Boilers.—General description of common types. Boiler—accessories and mountings.

Steam and other heat Engines.—General description of—modern steam engines. Types of gas and oil engines, steam turbines—general arrangement of a Power House.

Hydraulic Machinery.—Plunger. Centrifugal and turbine pumps. Pelton wheel, inward and outward flow turbines.

Machine tools.—General description of lathes, drilling, shapping and milling machines. Arrangement of shafting and belting in a machine shop.

Elementary Electrical Engineering

General.—Electric and Magnetic circuits. conductivity and insulation of materials, measuring instruments direct current, principle of alternating current in single, two and three phase circuits.

Electric Machinery.—Description. principles of working and maintenance, characteristics of direct current and alternating current generators and motors.

Civil Engineering Drawing

Advanced exercises based on syllabuses in construction and hydraulics and irrigation engineering.

Machine Drawing

Advanced drawings of machine parts. Ability to supply some idea of proportions of the more simple machine details such as bolts, nuts, keys, cotters etc.

Field Engineering

Practical methods of handling material—Hoisting appliances—Simple machines—development of ability for making correct observations—Submission of report.

SYLLABUSES B. Sc. (TECHNOLOGY)

Scientific German

The Examination will be a test of the capacity of the student to translate freely from German scientific literature into English.

Mathematics

(Course for the first two years)

Analytical Geometry of the straight line and the circle, elementary properties of conic sections in their simplest form.

Differentiation; application to maxima and minima, and to tangents and normals; partial differentiation; small increments; Taylor's and Maclaurin's Theorems; power series, exponential and hyperbolic functions;

Integration, application to arcs, areas, volumes, surfaces and volumes of revolution, first and second moments of plane curves and areas; Pappu's theorem; Ordinary differential equations with constant coefficients, the linear equation, simple partial differential equations, with applications to heat conduction, probability and theory of errors; tolerance; numerical and graphical integration and differentiation.

Graphs of algebraic, exponential, logarithmic and Trigonometric functions, graphical solution of equations, Newton's method of solution, use of logarithmic and other special types of graph paper for fitting empirical curves to observed data; nomographs, use of the slide rule.

Note:—The stress should be on the utilitarian aspect rather than on the theoretical side, and the mathematical exercises should be selected as far as possible which have a bearing on Technology and Chemical Engineering.

Physics

Properties of Matter:—Elasticity and modulii—Surface tension—Capillary rise—Determination of surface tension—Viscosity—Diffusion—Fick's law.

Heat:—Measurement of low and high temparatures—Properties of gases and vapours—Isothermal and adiabatic expansion—Kinetic theory of gases — Vanderwaal's equation — Liquefaction of gases — Two specific heats of gases — Dew point—Hygrometry—laws of transmission of heat by conduction and radiation and convection—First law of thermodynamics—Mechanical equivalent of heat—Carnot's cycle—Thermodynnmic scale of temperature—Entropy.

Light:—Propagation of light—Photometry—Reflection and refraction at plane and spherical surfaces—Prisms—Minimum deviation — lenses, microscopes, telescopes, spectroscopes — and sextants—Chromatic dispersion — Achromatic combinations—General laws of radiation—Visible ultra-violet, infra-red—Emission and absorption—Distribution of energy in spectra—Line spectra—Zeeman effect—Phosphorescence and fluorescence—Raman effect—Measurement of velocity of light—Polarisation—Nichol Prism—Polarimeter.

Sound:—Velocity of sound in solids and gases—Determination of frequency by resonance column and sonometer—Musical scale.

Magnetism:—Magnetic moments—Intensity of magnetisation and magnetic induction—Hysteresis—Diamagnetism, paramagnetism, and ferro-magnetism. Laws of the magnetic circuit—Bhor magneton.

Electricity:—Electric current—Primary and secondary cells—Electrolysis — Faraday's laws — Voltameters — Magnetic field associated with current—Measurement of current—Galvanometers, Ammeters and Voltmeters—Measurement of Resistance and potential difference — Wheatstone's bridge — Potentiometer — Thermal effects of current—Electrical energy—Conversion of electrical energy into heat energy—Electrical power—Incandescent arc and vapour lamps—Cathode lamps—Conversion of heat into electrical energy—Thermopile—Thermocouple—Action of magnetic field on circuits—Conveying currents—Electromagnetic induction—Faraday's laws—Lenz's law—Dynamos and motors—Induction coil—Volt and current transformers—Induction heating—Power in A. C. Circuit—Conductance and capacity.

Modern Physics:—Conduction through gases — Discharge through gases—Cathode rays—X-rays—α, β and γ rays—Radioactivity—Nucleus—Electrons, protons and neutrons—cosmic rays.

H. F. Current—Thermionic A. C. Generator.

Laboratory course in Physics for Technology.

1. Fletcher's trolly.
2. Atwood's machine.
3. Cœfficient of friction.
4. q by stretching.
5. q by bending.
6. n by static method.
7. Surface tension by capillary rise.
8. Viscosity by capillary flow method.
9. Linear expansion of a rod—microscope method.

10. Specific heat of a solid.
11. Specific heat of a liquid by the method of cooling.
12. J by Callendar and Barnes method.
13. Hygrometer.
14. Thermal conductivity of copper.
15. Thermal conductivity of cardboard.
16. Pyrometer.
17. μ of a lens.
18. Liquid lens.
19. μ of a liquid by hollow prism.
20. Dispersive power.
21. Polarimeter.
22. Kundt's tube.
23. Melde's experiment.
24. Determination of M and H.
25. Hysteresis.
26. E. C. E. of copper.
27. Post Office Box.
28. Resistance of a galvanometer.
29. Measurement of low resistance.
30. Internal resistance of a cell
31. Resistance of an electrolyte.
32. Calibration of a voltmeter.
33. Calibration of an ammeter.
34. Comparison of resistance by potentiometer.
35. Temperature coefficient of resistance.
36. Efficiency of a lamp.

Chemistry.

Inorganic : Laws of chemical combination. Atomic Theory. Structure of the atom (only an elementary treatment). Methods of determining equivalent and atomic weights, Valency, Atomic number, Isotopes. Periodic classification. Study of the following, elements and their more important compounds from the stand point of periodic classification. (a) Rare gases, Halogens, H_2, O_2, S, Selenium, Tellurium, N_2, P, As, Sb, Bi, C, Si, Boron. (b) A general study of metallurgical operations. Minerals and ores and their occurence with special reference to India. Different methods of concentration of ores, different types of furnaces, general methods of extraction of metals and purification—Iron, Steels. Copper, Zinc, Lead, Aluminium, Chromium, Tin, Nickel, Platinum, Silver, Gold, Calcium, Magnesium, Sodium, Potassium, Tungsten. A general study of the more important compounds of the above metals.

Inorganic Practical: Analysis of mixtures containing the following radicals. Acid Radicals: CO_3, S, SO_3, S_2O_3, NO_2, NO_3 F, Cl, Br, I, ClO_3, C_2O_4, $C_4H_4O_6$, SiO_3, CH_3COO, BO_2, AsO_3, AsO_4, PO_4, CrO_4, SO_4, MnO_4.

Basic Radicals: NH_4, Na, K, Mg, Ba, Ca, Sr, Ni, Co, Mn Zn, Al, Cr, Fe, Sn, Sb, As, Cd, Cu, Bi, Hg, Pb, Ag.

Quantitative Analysis: Volumetric estimation of acids and alkalis, and carbonates. Oxidation reactions involving the use of $KMnO_4$, $K_2Cr_2O_7$, and I_2. Estimation of halides and cyanides by Argentimetry.

Gravimetric estimation of—water of crystallisation, Ba, Fe, Cu, Ca, Mg, Pb, Ag, Ni, Cr, Zn.

Analysis of alloys such as silver coin, brass, steel; ores such as dolomite, haematite, zinc blende, chrome-iron ore. Preparations such as Alums, Chromyl chloride, $KMnO_4$, $Na_2Cr_2O_7$ and isolation of salts from brine.

Organic Chemistry : The growth and the scope of organic chemistry. Purification of organic compounds with special emphasis on industrial processes. Analysis of organic compounds—qualitative and quantitative. Determination of molecular weights of organic acids and bases by chemical methods. Classification of organic compounds.

Study of Aliphatic or Open-chain compounds with special reference to industry. Saturated hydrocarbons, unsaturated hydrocarbons—Olefines and Acetylenes. Petroleum Industry. Halogen derivatives of the paraffins and unsaturated hydrocarbons. Alcohols — Monohydric saturated alcohols and unsaturated Monohydric alcohols. Fermentation Industry. Ethers, Aldehydes, and Ketones. Monobasic fatty acids—saturated acids and unsaturated acids. Acid chlorides, anhydrides and amides. Esters—esters of organic and inorganic acids. Soap. Mercaptans, Sulphonic acids and sulphonates, Thioethers. Amines. Cyanogen compounds—Cyanogen and hydro-cyanic acid ; halogen compounds of cyanogen—cyanic and cyanuric acids—Thiocyanic acid, Thiocyanates—Nitriles—Carbylamines.

Alkyl derivatives of Phosphorus, Arsenic, Silicon etc. Organometallic compounds. Synthetic uses of Grignard's Reagents. Polyhydric alcohols. Carbohydrates, Mono and disaccharides; an elementary idea of configuration of sugars.

Hydroxy monobasic acids and compounds related to them. Monohydroxy fatty acids—Stereo-isomerism of Lactic acids—Amino Acids—Dialdehydes—Diketones—Monobasic aldehydic and ketonic acids. Synthetic uses of Aceto-acetic ester. Dibasic acids—Carbonic acid derivatives—saturated and unsaturated. Dibasic acids—Monohydroxy and Dihydroxy Dibasic acids—Stereoisomerism of the Tartaric acids and Stereoisomerism of unsaturated acids—Hydroxy and polybasic acids. Study of the Chemistry of the cyclic compounds with reference to

industrial products. Carbocyclic compounds—Polymethelynes. Aromatic hydrocarbons including structure of benzene etc. Aromatic halogen derivatives; Aromatic Nitro-compounds; Explosives; Aromatic amines; Diazo and azo compounds; Aromatic sulphonic acids; Phenols; Aromatic alcohols; Aldehydes, and Ketones, Quinones; Aromatic acids; Aromatic compounds containing two or more benzene nuclei. Naphthalene and its derivatives. Anthracene and its derivatives. Phenanthrene.

Heterocyclic compounds—An Elementary study of the heterocyclic compounds with special reference to Furfurane. Thiophene, Pyrrole, Pyrazole, Pyrazolone, Indole, Cabazole, Pyridine, Quinoline, Isoquinoline and Acridine.

An elementary idea of the following:

1. Synthetic Dyes—Classification of dyes—Important dyestuffs of each class with special reference to Azo-dyes and Triphenyl-methane dyestuffs.

2. Ureids—Parabanic acid, Barbituric acid, Alloxan, Allantoin, Veronal, Uric acid, Theophylline, Caffeine, Theobromine, Purine, Xanthine, Guanine.

3. Terpenes and Camphors–Monocyclic Terpenes–Terpineol-Limonene—Menthone—Menthol. Dicyclic terpenes—Camphor—Pinene—Borneol. Olefinic terpenes—Isoprene—Citral–Geranial–Linalool.

4. Alkaloids—Classification of Alkaloids. An elementary study of the following alkaloids. Piperine, Conine, Nicotine, Atropine, Cocaine, Quinine, Cinchonine, Morphine, Strychnine, and Brucine.

5. Synthetic Drugs—Important compounds of Arsenic, Important members of the following classes of drugs–Antiseptics. Hypnotics and Anaesthetics—Antipyretics, Diuretics and Uric acid Eliminants.

Text books: Kipping and Kipping: Organic Chemistry.
Paul Karrer: Translated by A. J. Mee: Organic Chemistry.
Schmidt: Organic Chemistry.

Organic Chemistry Practical

Detection of the following elements in Organic Compounds :– Carbon, Hydrogen, Nitrogen, Halogens, and Sulphur. Identification of sample

(*a*) *aliphatic*: halogen substituted hydrocarbons, alcohols, ethers, aldehydes, ketones, acids (monobasic and dibasic), hydroxy acids, amines, amides esters, simple sugars.

(*b*) aromatic—hydrocarbons, phenols, ethers, alcohols, aldehydes, ketones, acids, hydroxy acids, nitro compounds, amines, amides, halogen derivatives.

Preparation of the following: Ethyl bromide, Iodoform, Acetyl chloride, Ethyl Acetate, Methyl Oxalate, Allyl Alcohol, Oxalic acid, Aniline, Acetanilide, p-nitraniline, m. dinitrobenzene, Phenyl Hydrazine, Methyl orange, Potassium Benzene sulphonate, Benzyl alcohol, Benzaldehyde, Benzoin, Naphthol yellow, Malachite green, and Acetophenone.

Books recommended: Laboratory outlines of organic chemistry, by Dey and Raman,
Throp and Whitley: Practical Organic Chemistry.

Physical Chemistry

Units of energy, heat etc. on the C.G.S. and F.P.S. system; B. T. U., C. H. U. etc. Value of gas constant in different units.

Properties of gases; Kinetic theory; Equations of state Critical constant; Joule-Kelvin Effect; Liquefaction of gases; Theory of corresponding states; Gaseous diffusion.

Laws of Thermodynamics—First and Second Laws—Thermo-chemistry.

Dilute solutions of non-volatile solutes; vapour pressure boiling point, freezing point, determination of molecular weights.

Law of mass action and Chemical Equilibria—Reaction kinetics—order of reaction.

Catalysis—Principles and main applications.

Heterogenous Equilibria—Phase Rule—Binary Systems only.

Colloidal State—Natural and Artificial Colloids, Properties of colloids and their application.

Radioactivity and Atomic Structure.

Electrochemistry—Electrical conductance, Faraday's Law Electrolytic Dissociation, Transport Number, Specific, Molar and Equivalent Conductance, Independent migration of ions, Electro lytic equilibrium and hydrolysis. Ionization of water, theory of indicators.

Electromotive Force; Relation between electrical energy and chemical energy; Electrolytic solution pressure; Single

Electrode Potentials; Electrolysis and Polarisation; Decomposition voltage; Energy efficiency; concentration cells. Normal electrode potentials; Chemical cells, Oxidation—reduction elements; Primary cells; Secondary cells.

Photochemistry and Photochemical reactions. Relation between chemical constitution and physical properties such as molecular volume, parachor, molecular refractivity, optical rotation etc.

Physical Chemistry Practical

Determination of Molecular weight (1) Victor-Meyer, (2) Boiling Point Method (3) Freezing point method, (4) Molecular refraction.

Thermochemistry (1) Determination of Heat of Neutralisation. (2) Heat of Combustion.

Chemical Kinetics :—The velocity of simple reactions

Polarimetry and the kinetics of the inversion of cane sugar

Miscibility of liquids—Phenol-water system; Partition coefficient; use of Thermostats; Steam Distillation.

Transition points and their determination.

Elementary Engineering Mechanics

Displacement—Velocity—Acceleration—Graphical representation of displacement, velocity and acceleration—Vector quantities—Velocities, Accelerations etc. considered as Vectors—Composition and Resolution of Velocities—Relative Velocity—Composition and Resolution of acceleration—Angular velocity and acceleration.

Motion under gravity—Motion on inclined planes—Projectiles, inertia, laws of Motion—Weight—Momentem, Units of force—Motion of connected bodies, Atwood's machine.

Work, graphical representation of work—Power, Energy, Principle of Work—Conservation of energy.

Circular motion, Centrifugal and centripetal forces, Motion in a curved track, Conical pendulum, Simple harmonic motion. Forces in simple harmonic motion, Alternating vectors, Simple pendulum.

Concurrent forces, Composition and Resolution of forces—Triangle of forces—polygon of forces—Analytical and graphical methods—Physical independence of forces—Moment of a force—Work done by torque—sliding friction—Angle of friction—Action of Brakes—Friction and Efficiency of screw.

Statics of rigid bodies—Parallel forces–Moments–Principle of Moments—Couples—Conditions of equilibrium—Analytical methods—Methods of sections.

Properties of Engineering materials, Stress, strain; compressive, tensile, shear and bearing stresses; stress-strain diagrams; Hooke's law, modulus of Elasticity, modulus of rigidity. Poisson's Ratio; Temperature stresses, composite bars; dead, live and shock loads; factors of safety, working stresses, Work, resilience; strength and efficiency of riveted joints; Bending movements and shearing forces in beams.

Drawing

Geometrical Drawing.

Plane geometry; Lettering, use of instruments, construction and use of scales; construction of ellipse, parabola, hyperbola, cycloidal and involute—curves: helix.

Solid Geometry :—Projections of points, lines and planes. Projections of simple solids such as prisms, pyramids, cylinders and cones in simple positions, development of plane and curved surfaces; interpenetration of solids; isometric projection and elements of perspective.

Machine Drawing. Ability to copy accurately to scale and to supply additional views. Drawing of simple machine parts from sketches and from measurements.

Applied Mechanics

Statics of Rigid bodies. Parallel Forces; Moments, Principle of moments; Couples, condition of equilibirum Analytical methods ;stress in frames by method of sections.

Centre of parallel forces; Centre of mass, Centre of gravity; Different states of eqilibrium; Theorem of Guldinus or Pappus; Moment of Inertia; Radius of Gyration; Laws of rotation of Rigid body; Kinetic energy of rotation; Kinetic energy of rolling body.

Hydrostatics; Pressure at a point and on a surface. Pressure gauges; Hydraulics; fluid friction; flow through orifices, notches and pipes.

Beams. Theory of bending; B.M. and S.F. in Cantilever; simply supported and overhanging beams. Elementary ideas of R. C. Beams, Columns and structs, torsion of shafts.

Graphic statics; Bow's notation; funicular polygon; Bending moment and Shearing force diagrams; stress diagrams of roof trusses.

Laws of machines ; Velocity ratio ; Mechanical advantage and efficiency of simple machines such as Jack Screw, Pulley Blocks, Wheel, and axle, worm and wheel.

Friction in bearing ; Belt friction ; Transmission of motion by belts ; Ropes and chains, Friction gearing, spar gearing, wheel train. Rack and pinion ; Crank and connecting rod mechanism, quick return motion, cams, ratchets.

Electrical Engineering

General laws and definitions ; Principles of Direct current and circuit ; Calculations Induction of currents ; Flemings Rule ; Lenz's law ; Practical application of induction , Self and Mutual Induction ; Magnetic properties of Materials ; General laws and Terminology ; Magnetic circuit ; Calculations. Electrical Measurements and measuring instruments.

Dynamos and Motors : Principles involved : Different types, and their functions ; Management ; Power and efficiency calculations. Accumulators : Principles involved Construction and maintenance.

Principles of A. C. ; current calculations ; Single phase, two phase and three phase current ; vector diagrams ; Simple Alternator : Induction and synchronous Motor ; Elementary theory of Transformers and their uses ; Rotary converter and Rectifiers.

Power transmission ; Switch-board diagrams ; Advantages of high tension alternating current transmission. Electro-deposition of metals : utility of A. C. and D. C. compared with respect to the adaptability to chemical industry. Cost of generation and upkeep.

Laboratory Work. Measurement of Resistance ; Measurement of Internal resistance of storage battery ; Calibration of Ammeter and Voltmeter ; Study of Energy-meters ; study of D.C. Generators (Shunt, Series and Compound) Characteristic of an A. C. Series Circuit : Study of Alternators (single and polyphase) Measurement of three-phase power by two wattmeters; Synchronising and parallel operation of two Alternators: study of a polyphase Induction Motor: Study of Transformers; Study of a rotary converter ; Study of an Induction Regulator.

APPENDIX B.

In Regulation 12 (1) (a) of chapter XX of the Laws (p. 159 of the Calendar 1942-45) add as sub-division (viii) the following at the end of the page :

(viii) Engineering and Technology Degree and Overseer Diploma Examinations :—

For setting any question paper :

for Engineering and Technology Examinations	Rs. 50/-
for setting any paper on Projects	Rs. 100/-
for setting any paper for Overseer Diploma	Rs. 40/-

II. In Regulation 12 (b) (p. 160 of the Calendar 1942-45) *add* the following as sub-division (iv) :—

(iv) B.E., B.Sc. (Tech.). Degree and Overseer Diploma Examinations :—

B.E., B Sc. (Tech.), Intermediate and Overseer Diploma : For valuing each answer book for all subjects : Re. 1/-

B.E., B.Sc. (Tech.) Final :—

For valuing each answer book (for all subjects except Projects)	Rs. 2/-
For valuing each answer book on Projects	Rs. 4/-

III. In Regulation 12 (2) (p. 160 of the Calendar 1942-45) *add* the following at the end of the page as a separate para :

(*a*) For Engineering and Technology and Overseer Diploma Examinations :—

A sum of Rs. 30/-will be paid for each batch of not less than 25 candidates for each test to be shared equally by the Examiners engaged in prescribing the work. Each examiner engaged in preparing for the practical examination shall be paid at the rate of 0-8-0 per candidate.

(*b*) In page 161 of the Calendar, after " B.Sc., Hons. " *add* the following :—

Engineering and Technology (for each examiner) : Rs. 1—8— 0 per candidate

Overseers (for each Examiner) Re. 1/- per candidate

APPENDIX C

Exemption to Bona fide Teachers

After Regulation 19 of Chapter XXVIII (p. 221 of the Calendar 1942-45) add the following ;—

20. The Syndicate shall have the power to grant exemption from the production of the certificate of attendance prescribed for the examinations of this University, to a bona fide wholetime teacher in this University or other recognised educational institution within the territorial jurisdiction of the University who has served as a teacher for a period of not less than 3 years prior to the date of the examination for which he offers himself as a candidate.

21. Applications for exemption under the preceding regulation should be made to reach the Registrar not later than the 1st November and 1st March preceding respectively the April and September Examinations of each year accompanied by a fee of Rs 10/- for considering each application.

22. Every applicant shall submit with his application (1) satisfactory evidence of his having passed an examination of this or other recognized University qualifying for admission to the examination for which he desires to appear and (2) a certificate signed by the Head of the Institution in which he is employed showing (a) the period of study spent by the applicant in preparing for the examination and (b) the total period of his service as a teacher.

23. A period of at least two years must elapse between the date of his passing the preceding qualifying examination and the date of appearing for the next higher examination e.g. (1) Intermediate two years after passing the S. S L. C. or other equivalent examination (2) B.A. B.Sc. Degree—two years after passing the Intermediate or other equivalent examination.

24. No candidate will be permitted to appear in a group or a language which is not offered by the University for the examinations of that year.

APPENDIX D

To be incorporated as a separate Chapter.

These regulations are framed under Transitory Regulation 21 of Chapter XXVIII (pp. 223 of the Calendar 1942-45.).

B. A. and B. Sc. "War Degree."

1. The *B. A.* or *B. Sc.* "*War Degree*" will be conferred on candidates with approved war service in His Majesty's Forces who desire to offer themselves as candidates for this degree in conformity with the conditions hereinafter laid down.

2. A candidate for the degree whose studies have been interrupted, shall be required to have passed the Intermediate Examination of this or any recognised University at least two years prior to his appearance to the War Degree Examination and to have had not less than one year of approved war service.

3. He shall further be required to have passed in two subjects, *either* English under Part I and one optional subject *or* two optional subjects under Parts III and IV of the examination under the existing regulations for the award of the B. A. or B. Sc. Degree.

4. An applicant who has already passed in any one of the subjects mentioned in regulation 3 supra at the B. A. or B. Sc. Degree Examination of this or any other recognised University shall on his passing the other subject, qualify for the B. A. or B. Sc. War Degree as the case may be.

5. He will be granted exemption from the production of the certificates prescribed provided however that he shall submit a certificate of fitness duly signed in the form prescribed below.

6. The marks qualifying for a pass in any subject shall be the same as those prescribed for the B. A. or B. Sc. Degree Examination under the existing regulations and the successful candidates will not be classified.

7. The regulations in this chapter shall be in force for a period of two years, *i. e.* until June 30th, 1948.

Certificate to be produced by candidates for "War Degree."

(1) By applicants offering Arts subjects.

I certify that.....has been pursuing the study of the text-books prescribed in.....(subjects) for the B. A. Degree Examination and has reasonable chances of passing.

Command Education Officer.

(ii) By *applicants offering* Science subjects.

I certify that.....has been taking practical instruction in.....(subjects) and he may be permitted to offer the subjects for the B. Sc. Degree Examination.

Head of the Department in.....

Trichinopoly United Printers Ltd.,—3-9-46—500