

College of Engineering & Technology, Bengal



PROSPECTUS

SESSION 1950-51

P. O. Jadavpur College, Calcutta-32

JADAVPUR UNIVERSITY

LIBRARY

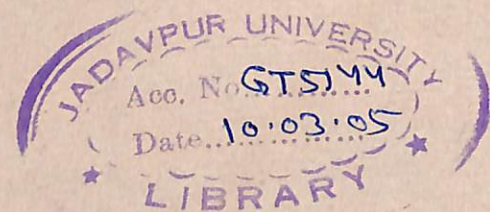
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The College reserves the right to make changes in the regulations and courses announced in this prospectus.



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HISTORY OF THE COLLEGE

The years 1905-06 are memorable ones in the annals of Bengal and indeed in the annals of India. The attempt by the Government to partition Bengal led to a country-wide agitation and intense nationalist movement, which, although political at the outset, had important economic and cultural aspects as well. The economic aspect of the movement found expression in the production and use of "Swadeshi" goods. The cultural aspect found expression in many forms, in the regeneration of Indian art and music, but most of all in the boycott of the then prevalent system of education and the establishment of a new system based entirely on national lines and intended to serve only national purposes.

It was in this way that the National Council of Education was started in 1906 "to impart education—literary and scientific as well as technical and professional—on national lines and exclusively under national control, not in opposition to, but standing apart from the existing system of primary, secondary and collegiate education, attaching special importance to a knowledge of the country, its literature, history and philosophy, and designed to incorporate with the best Oriental ideals of life and thought the best assimilable ideals of West, and inspire students with the genuine love for and desire to serve the country." The foundation of the National Council of Education was rendered possible by the munificence of three generous donors, the late Raja Subodh Chandra Mallick, S. Brojendra Kishore Roy Choudhury of Gouripur and the late Maharaja Suryya Kanta Acharya Choudhury Bahadur of Mymensingh. The first President of the Council was Sir Rash Behari Ghosh, and with the early days of the N. C. E. were associated nearly all the notable figures of the time, some of whom later won world recognition, men like Poet Rabindranath Tagore, Sri Aurobindo and others.

In 1906, the year of the foundation of the National Council of Education, Bengal, there was established another body known as the Society for the Promotion of Technical Education in Bengal also under the Presidentship of the late Sir Rash Behari Ghosh, with the object of imparting scientific and technical education to the Indian people, calculated to further their industrial progress. Under the auspices of this Society there was started the Bengal Technical Institute (now

known as the College of Engineering and Technology, Bengal), financed mainly by the late Sir Taraknath Palit. In 1910, the Society for the Promotion of Technical Education in Bengal was amalgamated with the National Council of Education.

The National Council at first maintained both Arts and Science and Technical Departments, but finding that public demand for Technical education was more insistent, the Council has been devoting for the last 30 years almost the whole of its resources to technical education through its College of Engineering & Technology.

In 1921 the Council had the good fortune to secure a donation of about 13 lacs (13,00,000) of rupees under the Will of the late Sir Rash Behari Ghosh. This princely bequest enabled the Council in 1924 to erect extensive buildings and workshops on its present site at Jadavpur. Besides the donations and endowments of the founders mentioned above, the Council has received up to date a sum of about 10 lacs of rupees as donations from various persons. The present site of the College of Engineering & Technology is a gift of the Corporation of Calcutta, which leased out to the Council 192 bighas of lands on a nominal rent. Besides this extensive plot of land, the Corporation has been making an annual grant of Rs. 30,000/- since 1927. Later on the Corporation made a non-recurring grant to the Collge of nearly 1½ lac of rupees, partly as a loan and partly as a gift.

The Government of West Bengal have made a non-recurring grant of 3 lacs of rupees and a recurring one of 40 thousand rupees per annum for the further development of the Chemical Engineering Department of this College. In addition they have made non-recurring and recurring grants for developments of the Overseer Course.

The Government of India have sanctioned the following very handsome grants and loans :—

(a) Capital grant—		
(i) for College buildings	...	Rs. 3,83,000
(ii) for Equipments	...	Rs. 21,77,000
(b) Recurring Annual Grant	...	Rs. 5,98,000
(c) Interest-free Loan for Construction of Students' Hostels	...	Rs. 13,91,000

These grants by the Central Government will enable the College to serve the country in a far more effective way than she is doing now.

College of Engineering & Technology, Bengal

THE FACULTY

Principal :

Dr. Trigunacharan Sen, Dr.Ing.(Munich), A.M.M.E.(B. Tech),
M.I.E.(Ind.)

Registrar :

Sri Prabir Chandra Vasu Mallik, M.A.(Cantab)

DEPARTMENT OF MECHANICAL ENGINEERING

Professor-in-Charge :

Dr. Satish Chandra Bhattacharyya, M.Sc.(Cal.), Dr.Ing.(Berlin),
A.M.M.E., A.M.E.E., V.D.I., M.I.E.(Ind.)

Professors :

Dr. Jatindra Nath Basu, Dr.Ing.(Berlin), A.M.M.E., A.M.E.E.,
M.I.E.(Ind.), V.D.I.

Sri Sudhir Kumar Chakravarti, B.S.(Worcester), M.S.(Michigan),
A.M.M.E.

Sri Satyendra Bimal Sen, B.Eng.(Sheffield),
A.M.I.Mech.E.(London)

Sri Amiya Kumar Basu, B.Sc.(Cal.), A.M.M.E.
Sri Gopal Chandra Sen, M.S.E.(Michigan), A.M.M.E.

Visiting Professor :

Sri Jnan Ranjan Basu Mallick, M.Sc.(Cal.), M.S.(M.I.T.), M.A.S.R.E.,
A.M.A.S.H.V.E., A.M.Inst.R.(London)

Dr. Sivasundar Deb, Dr.-es-Sc.(Paris)

Asst. Professor :

Sri Nirendra Nath Chattopadhyay, B.Sc.(Cal.), B.M.E.

Lecturers :

Sri Sailaja Charan Sen Gupta, A.M.M.E.
Sri Ananga Mohan Chatterjee, A.M.M.E.
Sri Pravash Chandra De, B.M.E.
Sri Benode Lal Das, B.M.E.
Sri Girindra Nath Das, B.M.E.

Lecturers—contd.

Sri Amulya Prosad Ghosh, B.M.E.
 Sri Bibhuti Bhusan Majumdar, B.M.E.
 Sri Protap Chandra Roy, B.M.E.
 Sri Charu Chandra Bhattacharyya, B.M.E.
 Sri Bhabatosh Mukherjee, M.S.(Illinois), B.M.E. (on study leave)
 Sri Madhu Sudan Sen Gupta, B.Sc., B.M.E.
 Sri Bimaladas Banerjee, B.M.E.
 Sri Hari Das Banerjee, B.M.E.
 Sri Bireswar Prosad Ghosh, B.M.E.
 Sri Santosh Kumar Banerjee, B.M.E. (on study leave)
 Sri Sachindra Nath Bhaduri, B.M.E.
 Sri Joydeb Chandra Das, B.M.E.
 Sri Krishna Chandra Chatterjee, B.M.E.
 Sri Jyotish Chandra Sarkar, B.M.E.
 Sri Anil Kumar Chowdhury, B.M.E.
 Sri Prakriti Bhusan Chatterji, B.M.E.
 Sri Sukumar Datta, B.M.E.
 Sri Amarendra Nath Chakraborty, B.M.E.
 Sri Narayan Chandra Kundu, B.M.E.
 Sri Rajat Kumar Chakraborty, B.M.E. (on leave)
 Sri Profulla Chandra Choudhury, B.M.E.
 Sri Probodh Kumar Chakraborty, B.M.E.
 Sri Sudhir Kumar Das, B.M.E. (on loan to Automobile Department)
 Sri Probbhash Kumar Sen, B.M.E. (on loan to Automobile Dept.)
 Sri Kartick Chandra Das, B.M.E.
 Sri Arun Kumar Gupta, B.M.E.
 Sri Benoyendra Nath Chandra, B.M.E.
 Sri Tarun Kumar Bhattacharyya, M.Sc.

Instructor :

Sri Pulin Behari Bhattacharyya

DEPARTMENT OF ELECTRICAL ENGINEERING

Professor-in-Charge :

Sri Hem Chandra Guha, B.Sc.(Edin.), Mem.A.I.E.E.(U.S.A.),
 A.M.I.E.E.(London), M.I.E.(Ind.)

Professor Emeritus :

Sri Surendra Kumar Roy, M.E.E.(Harvard), M.A.I.E.E., M.I.E.(Ind.)

Professors :

Sri Manmatha Nath Chakraborty, B.Sc.(Cal.), B.S (Worcester),
 M.S.(Purdue), A.M.E.E.
 Dr. Moti Lal Jain, D.Sc.(Harvard), M.E.E.(Cornell),
 B.Sc. Eng.(Benares)

Asst. Professors :

Sri Debendra Nath Chakraborty, B.E.E., A.M.I.E.(Ind.), A.M.A.E.
 Sri Mohi Mohan Mukherjee, M.S.(Washington), A.M.M.E.,
 M.A.I.E.E.(U.S.A.)

Lecturers :

Sri Dharendra Kumar Deb, A.M.E.E. (on study leave in U.S.A.)
 Sri Mriganka Mohan Kar, B.Sc.(Cal.), B.E.E., A.A.I.E.E.(U.S.A.)
 Sri Benoy Krishna Sarkar, B.E.E.
 Sri Danindra Nath Roy Bardhan, B.E.E., A.A.I.E.E.(U.S.A.)
 Sri Prokash Chandra Mondal, B.Sc.(Cal.), B.E.E.
 Sri Probhat Kumar Sadhukhan, B.E.E.
 Sri Amar Nath Das, B.E.E.
 Sri Arabindo Das, B.E.E., B.M.E. (on study leave)
 Sri Abanindra Nath Deb, B.E.E.
 Sri Shyamapada Patra, B.E.E. (on study leave)
 Sri Sudhindra Kumar Basu, B.E.E.
 Sri Ardhendu Sekhar Sanyal, B.E.E.
 Sri Akshay Kumar Ghoshal, B.E.E.
 Sri Sailesh Chandra Das Gupta, A.M.E.E.
 Sri Gobinda Prosad Purakayastha, B.E.E.

DEPARTMENT OF CHEMICAL ENGINEERING

Professor-in-Charge :

Dr. Hira Lal Roy, A.B.(Harvard), Dr.Ing.(Berlin), M.I.Ch.E.,
 M.I.E.(Ind.)

Professors :

Sri Baneswar Dass, B.S.Ch.E.(Illinois)
 Dr. Sachindra Nath Mukherjee, D.Sc.
 Dr. Anil Kumar Mazumder, D.Sc., A.R.I.C.
 Dr. Dilip Kumar Banerjee, D.Sc.
 Dr. Bidyut Kamal Bhattacharyya, D.Sc. (on study leave in U.S.A.)

Dr. Arabinda Nath Bose, M.Sc.(Cal.), Ph.D.(M.I.T.)
Sri Gopal Chandra Banerjee, M.Sc.

Asst. Professors :

Sri Provat Kusum Ray, M.Sc.
Sri Dilip Kumar Dutta, B.Sc.(Cal.), B.Ch.E., M.S.(Carnegie)
Sri Hari Gopal Ganguli, A.M.M.F.
Sri Aswini Kumar Pal, A.M.M.E.
Sri Jatindra Mohan Palit, B.E.E., A.M.M.E., A.M.I.E.(Ind.), A.M.A.E.

Hony. Lecturer in Chemical Engineering :

Dr. H. E. Eduljee, Ph.D.(London), A.M.I.Ch.E.

Lecturers :

Sri Bimal Chandra Chanda, B.Ch.E.
Sri Kamalendu Sen Gupta, M.Sc.
Sri Sudhir Chandra Das Gupta, B.Sc.
Sri Tarun Kumar Ghosh, B.Ch.E.
Sri Prasun Kumar Dey, M.Sc.
Sri Lochhu Pochhali, M.Sc.
Sri Nitish Chandra Chakraborty, B.Ch.E.
Sri Ramendra Nath Sen Sarma, M.Sc.
Sri Kshirod Chandra Chaudhury, B.Sc.(Cal.), B.Ch.E.
Sri Buddhadev Sen, M.Sc.
Sri Probodh Ranjan Sinha, M.Sc.
Dr. Nalini Ranjan Mukherjee, B.Sc.(Cal.), B.Ch.E.,
Ph.D.(London), (on study leave in U.S.A.)

PHYSICS

Professor :

Sri Purna Chandra Biswas, M.Sc.

Asst. Professors :

Sri Naresh Chandra Sen, M.Sc., B.L.
Sri Hari Pada Sen, M.Sc.

Lecturers :

Sri Upendra Nath Banerjee, M.Sc., B.A.
Sri Lakshmi Kanta Coondoo, M.Sc.
Sri Sudish Kumar Mukherji, M.Sc.
Sri Gopal Chandra Bhattacharyya, M.Sc.

MATHEMATICS

Professor :

Vacant.

Asst. Professor :

Sri Amar Nath Pramanik, M.A.

Lecturers :

Sri Sudhindra Nath Chaudhury, M.Sc. (on study leave in France)
Sri Dibendra Nath Mukherjee, M.Sc.
Sri Rampada Bhattacharyya, M.Sc.

HISTORY AND ENGLISH

Asst. Professor :

Dr. Siba Pada Sen, B.A.Hons.(London), D.Phil.(Cal.)

Lecturer :

Sri Khagendra Nath Das Gupta, M.A.

ENGINEERING ECONOMICS

Visiting Professor :

Sri Debabrata Basu, B.Sc., C.A., R.A.

DEPARTMENT OF OVERSEER

Asst. Professors :

Sri Arun Kumar Basu, B.Sc.(Cal.), B.Eng.(Sheffield)
Sri Jatindra Nath Bal, B.Sc.(C.E.) Hons.(Edin.), B.Sc.Hons.(Cal.)

Lecturers :

Sri Girindra Narayan Das
Sri Amiya Kumar Banerjee, B.M.E.
Sri Prafulla Kumar Mukherjee, A.M.M.E.
Sri Girija Bhusan Pal, B.M.E.
Sri Anil Kumar Chatterjee, B.M.E.
Sri Sudhindra Sarcar, B.E.
Sri Tarani Kumar Banerjee, B.E.

Instructor :

Sri Pramatha Nath Roy

DEPARTMENT OF AGRICULTURE

Professor :

Sri Benoyendra Nath Mandal, B.Sc.(Wales), C.D.D.(Aberystwyth)

Lecturer :

Sri Harendra Kumar Mazumdar, M.Sc.

DEPARTMENT OF AUTOMOBILE ENGINEERING

Lecturers :

Sri Samarendra Nath Halder (service lent to Calcutta Corporation)

Sri Sudhir Kumar Das, B.M.E.

Sri Sudhi Ranjan Das Gupta, A.M.E.E.

Sri Probhash Kumar Sen, B.M.E.

TEACHER OF RELIGION

Vacant.

PHYSICAL CULTURE

Sri Monohar Bhusan Aich

Sri Jahar Paul.

MECHANICAL SUPERVISOR

Sri Hara Mohan Bose, A.M.E.E.

ELECTRICAL SUPERVISOR

Sri Bhawani Ch. Mitra, F.M. & U.S.

LIBRARY

Sri Niranjana Chandra Maitra, B.Sc., B.A., Dip.Lib., *Librarian*

Sri Purna Chandra Chakravorty, (Certificate in Librarianship Training), *Asst. Librarian*

Sri Prafulla Kumar Sen, *Library Assistant*

COLLEGE CAMPUS

Location. The College stands on a fine piece of land measuring 172 bighas at Jadavpur within 5 miles by rail from the Sealdah Railway Station (Calcutta). The location is in the immediate vicinity of the Jadavpur Station and is also approachable by bus from Calcutta.

Buildings. The arrangements for instruction in the several departments of the College have been made in six spacious buildings. The main building, which is a three-storied one, occupies a floor space of 39,000 sq. feet. The Main Chemical Engineering Building has a total floor space of 18,200 sq. feet, and the Chemical Technology building covers a total floor space of 13,000 sq. feet. The Physics and the Electrical Engineering Department are housed in a two-storied building; the ground floor which has a total floor space of 12,000 sq. feet is occupied by the Electrical Engineering Laboratory and the first floor occupied by the Physics Laboratory has a floor space of 10,000 sq. feet. The Mechanical Engineering Laboratory and the Power Plant have a floor space of 15,000 sq. feet in another building. The workshops are in spacious corrugated-sheds with a floor space of 48,000 sq. ft. There is another corrugated-shed for Foundry and Smithy. Elaborate extensions of the Mechanical Engineering and the Electrical Engineering Laboratories are ahead. Besides there is a separate Store-shed.

There are also two hostel-buildings, one dining hall for the same and five staff quarters at present within the campus.

There is a two-storied building with a floor space of 4,000 sq. feet comprising the Old Boys' Home and the Pavilion of the College Sporting Club. There is also a covered gymnasium with a floor space of 4,100 sq. feet. Two new sheds with a total floor space of 7,800 sq. feet have recently been constructed to accommodate different classes.

LIBRARY, LABORATORY AND WORKSHOP

Library. The Library which is located in the Main College Building contains approximately 16,000 volumes. There is a well-equipped Reading Room attached to the Library to enable the students

to utilise their leisure hours for general study. Besides, there are Departmental Libraries in the Electrical Engineering Department and in the Chemical Engineering Department mainly for the use of the students and staff of the two Departments.

The Electrical Engineering Laboratory is equipped with representative types of D.C. and A.C. machines. Bench Testing provisions include a Cathode Ray Oscillograph, an Electro-magnetic Oscillograph, D.C. Potentiometer, etc.

The Mechanical Engineering Laboratory is equipped with representative types of Steam and Oil Engines, a Gas Engine, a Steam Turbine, a Gas Generator and two Boilers. There are various types of Calorimeters, equipment for calibration of gauges, a Universal Testing Machine, and accessories for running tests on pumps, boilers, engines, and the turbine.

The Chemical Engineering Laboratory equipments include an Oil Extraction Plant, a Soap Plant, an Electroplating Plant, a Water Distillation Plant, different types of furnaces, Equipment for Refining of Vegetable Oils, etc.

The Chemical Engineering Department has been provided with a fully equipped Unit Operations Laboratory of Chemical Engineering and an Electro-chemical Laboratory with funds offered by the Government of Bengal.

Students will also have facilities to work in the Laboratories of the Glass and Ceramic Research Institute which is being set up by the Government of India adjoining our Campus.

The Workshop is well equipped with representative types of machine tools and accessories for providing workshop training in Carpentry, Smithy, Foundry, Pattern Making, Fitting and Machine Shop.

Besides, a large Machine Shop equipped with an overhead travelling Crane and a large number of most up-to-date machine tools has recently been acquired and will provide unusual facilities for machine tool work, electric and gas welding, etc.

COURSES OF STUDY

The College offers :

1. Post Graduate Courses in Electrical, Mechanical and Chemical Engineering, leading to the degrees of Master of Electrical Engineering (M.E.E.), Master of Mechanical Engineering

(M.M.E.) and Master of Chemical Engineering (M.Ch.E.) respectively. Minimum requirement of attendance for these courses is one year.

2. Degree Courses in Electrical, Mechanical and Chemical Engineering, leading to the Degrees of Bachelor of Electrical Engineering (B.E.E.), Bachelor of Mechanical Engineering (B.M.E.) and Bachelor of Chemical Engineering (B.Ch.E.) respectively. Each of these is a four years' course.
3. An Overseer Course of three years.
4. An Agriculture Course of two years.
5. An Automobile Engineering Course of two years.

ADMISSION REQUIREMENTS

1. ADMISSION TO THE POST GRADUATE COURSES :

Honours Graduates in Electrical, Mechanical and Chemical Engineering of recognised universities and engineering graduates engaged in teaching work in this College for a period of at least two years are eligible for admission into these Courses.

2. ADMISSION TO THE DEGREE COURSES :

Students who have passed at least the I.Sc. or equivalent Examination in the First or Second Divisions of any recognised University with Physics, Chemistry and Mathematics and those who have passed the B.Sc. Examination with Physics, Chemistry and Mathematics of any recognised University are eligible for admission into the Engineering First Year Class of any of the three Degree Courses. The Pre-Engineering Examination of the Delhi Polytechnic Institute which has been recognised by the Calcutta University as equivalent to their I.Sc. Examination, is recognised for purposes of admission into the Degree Courses of this College.

Candidates for the B.M.E. and B.E.E. degrees after obtaining one of the above degrees will be required to study for two years before they are allowed to go up for the examination for the other Degree subject.

Students who pass the Final School Standard Examination of the National Council of Education, Bengal, will be admitted to the Engineering First Year Class of the College after two years' training in the Diploma Course in Engineering provided they satisfy the Principal

about their eligibility for admission after such training in the Diploma Course in Engineering.

Students who have passed the Matriculation Examination and have passed the Final Technical Course Examination or the Diploma course in Engineering of the College at least in the Second Division will be eligible for admission into the First Year Class of the Engineering Course.

3. ADMISSION TO THE DIPLOMA COURSE :

The Overseer Course.

The Agriculture Course.

The Automobile Engineering Course.

The minimum qualification for any candidate for admission into any one of the courses mentioned above is that he has passed the Matriculation Examination of any recognised University or the Final School standard Examination of the National Council of Education, Bengal, or any other School Final Examination of equivalent standard.

ADMISSION PROCEDURE

Candidates seeking admission into the College for any of the Courses should apply to the Principal giving particulars required in the printed Admission Form obtainable on application from the College Office.

The Admission Form, duly filled in, must be submitted with a Registration Fee of Rs. 5/- for Post Graduate & Degree Courses and Rs. 4/- for Diploma Courses by the 30th of April.

Application forms must be properly filled in. Incomplete or irregular applications will not be entertained.

Registration of name does not confer any right on the applicant for being called for interview ; a candidate is called for interview only when the Selection Board deem that an interview is warranted. Registration fee is not refunded under any circumstances.

Candidates selected for interview and coming from outside stations are informed that selection for interview is no guarantee, nor even a formal promise, that they will be selected for admission. Candidates are selected for admission when they can satisfy the Selection Board.

Candidates selected for interview will be informed at what time they are to appear before the Selection Board. Candidates not selected for interview will also be informed that they have not been selected ;

the Selection Board will not give any cause or explanation for not selecting any Candidate.

Interview cards are generally issued from this office by the middle of June or earlier or later according to the time of publication of the results of the I.Sc. Examination of Calcutta University. The College does not assume any responsibility for postal transit troubles, *viz.*, delay or non-delivery.

Applicants must communicate to this office the results of the examination, at which they appeared last, as soon as they are published if not previously communicated. Certificates of any description (original or copy) excepting University Certificates, will not be returned. Only copies are to be sent.

For want of accommodation in the hostels of this College, no guarantee of accommodation can be given to new entrants.

A written test examination will be held for candidates of all provinces, desiring admission into the First Year Classes of the Degree Courses of the College, mainly to ascertain their practical bias.

Only the candidates who have passed the I.Sc. or equivalent examination with Physics, Chemistry and Mathematics in the 1st or 2nd Division or who have passed the B.Sc. Examination with Physics, Chemistry and Mathematics, will be allowed to sit for the Admission Test Examination.

Only the knowledge of graphical solution of numerical problems on Statics and Dynamics as prescribed in the syllabus for I.Sc. Examination of the Calcutta University will be the syllabus of the Admission Test Examination.

Equal weightage will be given to the result of the Admission Test and to the result of the last examination in which the candidate appeared.

Interview will be granted to students strictly in order of merit on the combined results of the examinations to fill up the seats of the First Year Classes of the Degree Courses.

Candidates are to bring their own instruments for the Admission Test Examinations.

FEES AND DEPOSITS

1. TUITION FEE for students getting admitted into the Post Graduate Courses of this College is Rs. 240/- per annum payable in monthly

instalments of Rs. 20/- up to the month of February of each academic session. (Re: fees from March to June, see rule 5.)

2. TUITION FEE for all students taking admission into the Engineering Courses of the College is Rs. 180/- per annum payable in monthly instalments of Rs. 15/- up to the month of February of each Academic Session. (Re : fees from March to June, see Rule No. 5).

3. TUITION FEE for students in the Overseer Course of the College is Rs. 120/- per annum payable in monthly instalments of Rs. 10/- up to the month of February of each Academic Session. (Re: fees from March to June, see Rule No. 5).

4. TUITION FEE for students in the Agriculture Course of the College is Rs. 60/- per annum payable in monthly instalments of Rs. 5/- up to the month of February of each Academic session. (Re : fees from March to June, see Rule No. 5).

5. TUITION FEES for the months of April, May and June of each Academic session must be paid along with the Tuition Fee for the month of March, failing which permission to appear in the Annual Examinations will be withheld.

6. (i) TUITION FEE must be paid on or before the 15th of every month submitting the Fee-book which may be obtained from the Office on payment of annas four (-/4/-) per Fee-book per year.

(ii) Defaulters shall pay a fine of one pice for each day after 15th till the day on which their fees are paid and their names are also liable to be struck off at the end of the month in which default has been made.

(iii) Defaulters whose names have been struck off may be re-admitted on payment of tuition fees for the session due up to and inclusive of the month of such re-admission together with a re-admission fee of Re. 1/-.

(iv) Re-admission fee and fines may be remitted wholly or partly in special cases on good and sufficient grounds.

7. No student shall be permitted to appear in the Annual Examinations unless he has paid his tuition fees and other dues including Hostel charges, if any, for the whole session.

8. At the time of admission to the College the following fees are payable by new entrants :

	Admission Fee	Tuition Fee for July	Magazine Fee	Contingency Fee	Students' Union Fee	Sporting Fee	Students' Aid Fee	Caution money deposit	Medical Examination Fee	TOTAL
Students admitted into the Post Graduate Classes ...	20/-	20/-	2/8	2/-	1/-	5/-	-/8/-	25/-	1/-	77/-
New students admitted into the First Year Class :										
(I) Engineering Department ...	15/-	15/-	2/8	2/-	1/-	5/-	-/8/-	10/-	1/-	52/-
(II) Diploma Course in Engineering ...	10/-	10/-	2/8	2/-	1/-	5/-	-/8/-	10/-	1/-	42/-
(III) Overseer Department ...	10/-	10/-	2/8	2/-	1/-	5/-	-/8/-	10/-	1/-	42/-
(IV) Agriculture Department ...	5/-	5/-	2/8	2/-	1/-	5/-	-/8/-	10/-	1/-	32/-
(V) Automobile Engineering Department ...	...	200/-	2/8	2/-	1/-	5/-	-/8/-	15/-	...	226/-
9. All students shall pay the following fees in January every year along with the Tuition Fee for the month ...			2/8	2/-	1/-	5/-	-/8/-	...	...	11/-

The caution money deposit of the Chemical Engineering students is Rs. 25/-.

All students excepting the newly admitted students will have to pay a Medical Examination Fee of Re. 1/- in July.

10. Admission once taken into any class shall be counted to be for one complete session.

When a student has been admitted he shall not ordinarily be allowed to take transfer or withdraw his name except on payment of tuition fees for the unexpired portion of the session and arrears of tuition fees and other charges if any.

Remission of tuition fees for the unexpired portion of the session and other charges, if any, may be made by the Managing Committee wholly or partly in special cases on good and sufficient grounds.

Note.—Caution money deposit for working in the laboratories, workshops and other practical classes is refundable at the end of the College career after deduction for breakage or dues if any. The Student must apply for its refund

from the College within two years after he leaves the College and if he fails to do so, his deposit money will be forfeited.

At the beginning of each session students are to pay their respective breakage charges of the previous session.

STIPENDS, SCHOLARSHIPS & FREE STUDENTSHIPS

Stipends, Scholarships and Free Studentships are awarded to poor and meritorious students and the continuance of the same depends on good progress, regular attendance and good behaviour.

Scholarships in the form of Half-free Studentships are awarded for two years to teachers of this College prosecuting studies in Post Graduate Courses.

Scholarships in the form of Free Studentships are awarded to students who passing in all subjects, head the lists of successful candidates in the First and Intermediate Engineering Examination in the following way :

Examination	Position	Minm. Marks in Annual Examination	Tenure
<i>First Engineering—</i>			
Chemical	1st	70%	One year.
Mechanical & Electrical ...	1st, 2nd & 3rd	70%	One year.
<i>Intermediate Engineering—</i>			
Chemical	1st	70%	Two years.
Mechanical & Electrical ...	1st, 2nd & 3rd	70%	Two years.

Scholarships in the form of Free Studentships are awarded to students who head the lists of successful candidates in the Annual Examinations of the First and Second Year Classes of the Diploma Course in Engg. and Overseer Courses, securing not less than 70 per cent of the total marks.

Free-students, if they leave the College without sufficient and satisfactory reasons, must pay fees for the full period for which they were allowed exemption.

Loan scholarships, in lump sums, to meet Examination and College fees are awarded by the Alumni Association, N. C. E., Bengal, to deserving Final Year students under straitened pecuniary circumstances. Loans are also given to deserving students from the Students' Welfare Fund.

Deserving students may also avail of the following Stipends and Scholarships :

Goopee Kristo Bose Stipend.

Nemai Chand Chatterjee Stipend.

Kristo Mohon Bose Stipend.

Rasul Memorial Scholarship.

Dwijendra Memorial Scholarship.

Mani Lal Chatterjee Stipend.

Nabanalini Debi Stipend.

Mary K. Das & Taraknath Das Scholarship.

Sreemat Bhagabat Scholarship.

West Bengal Govt. Scholarships :—

(i) 48 Stipends of the value of Rs. 300/- each per year for Degree Courses.

(ii) 36 Stipends of the value of Rs. 200/- each per year for Diploma Students.

S. Ghose Memorial Scholarship of the value of not less than Rs. 700/- a year is awarded to a deserving Bengali Hindu candidate who has passed the Final Examination of the National Council of Education, Bengal, in Electrical Engineering to enable him to obtain Practical training in the subject abroad.

Prizes are awarded to students who stand first in any paper of the First Engineering Examination securing not less than 80 per cent marks in the paper, and to those who stand first in any paper of the Intermediate and Final Engineering Examinations of the Third Year Classes securing not less than 70 per cent marks in the paper.

Prizes are awarded to students who stand first in any paper in the Annual Examinations of the Diploma Course of Engineering First and Second Year Classes, the Overseer First Year and Second Year Classes and the Agriculture First Year Class securing not less than 80 per cent marks in the paper.

Prizes are awarded only to those students who have passed in all papers of their respective examinations.

COLLEGE HOSTELS

1. There are College Hostels within the campus with accommodation for 100 students only. *Steps are being taken to provide Hostel accommodation for all students.*

2. Applications from new students for admission into the hostel will only be considered after they have been admitted into the College.

Every admission shall be subject to the approval of the Principal. Boarders are liable for all charges from the beginning of the session.

3. All admissions are understood to be for a complete session, and boarders are liable for all charges from the beginning of the session.

4. Caution money of the amount of Rs. 50/- is payable in advance with every application for admission. The sum will be refunded in case a seat is not provided or when a boarder finally leaves the Hostel but in the latter case only after all dues have been paid up by him.

5. Admission fee of Rs. 5/- for a complete term shall be paid by every student on admission into the Hostel. Substitutes, when permitted, may however be exempted from such fees.

6. Each boarder shall have to pay the following scale of rent including charges for light and medical attendance by the 10th of every month. For each day's delay, a fine of one anna per day will be realised, up to 20th of the month, after which his name will be struck off from the College register and he shall have to leave the Hostel.

Ground Floor	...	Rs. 84/- per annum
First Floor	...	Rs. 96/- " "

7. The above rents will be realised in 10 monthly instalments beginning from the month of July in every session.

Monthly instalments of seat rent etc. for the current month and boarding charges for the previous month, must be paid at the office of the College in one sum.

8. The Hostel will remain closed during the Puja Holidays and Summer Vacation.

9. Withdrawal from the Hostel will require the sanction of the Principal of the College. Application for withdrawal must be countersigned by the guardian of the boarder.

GENERAL INFORMATION

(a) College Regulations :—

(i) *The New Student's Responsibility.*—With a student's first registration in the College there begins for him a period of great responsibility, greater, in most instances, than he has ever before been called upon to face. He should recognise that the success of his college career depends in large measure upon his own purpose, his own industry, and his own determination to make good use of his opportunities. The College offers instruction and the use of its equipments, teachers and other officers are ready to help with encouragement and advice ; but after all, the responsibility for success or failure must rest with the student himself.

(ii) *Discipline.*—All students are subject to the disciplinary control of the authorities of the College. In any case of serious breach of discipline, the student concerned may be suspended from attendance by the Principal, and the Managing Committee may at its discretion expel any student from the College without assigning any reason.

(iii) *Attendance.*—The normal hours of attendance during the session are from 10-30 A.M. to 5 P.M. with half an hour's recess.

Students must attend 70 per cent of the lectures in theoretical classes and 70 per cent of the exercises in practical classes. Percentage of attendance is strictly observed.

Percentage rules being binding on all students, applications for leave from the students or from the guardians on their behalf are unnecessary, as a student failing to be present in his class on any account has necessarily to be marked 'absent' in the Attendance Registers, and no commutation is permissible under any circumstances without contravention of the Rules.

(iv) *Damage to College Property.*—Each student is held accountable for any apparatus or equipment that may be assigned to him and for any damage to College Property for which he is responsible. Damage to property that cannot be charged to individuals will be charged against all the students in the class (or section) where the loss occurs.

(v) *Accidents.*—The College Authorities cannot accept any liability in respect of any accident which a student may sustain when engaged in practical work in the laboratories or workshops.

(b) *Students' Organisations and Activities :—*

Reasonable participation in extra-curricular activities is a worthwhile

part of a well rounded education. Opportunities for extra-curricular activities are provided through :

1. The Students' Union.
2. The Sporting Club.
3. The College Journal.

The Students' Union

All students of the College are members of the Students' Union. They meet and elect an executive Committee of which the Principal is the President and two members of the teaching staff are Vice-Presidents. The Vice-Presidents act as Faculty Advisers to the Executive Committee of the Students' Union, while the management of the Union's affairs are left entirely to that body.

The Union control the disposal of the Students' Welfare Fund, organise debates, essay competitions, dramatics, and other literary activities and hold one 'social' every year.

The Sporting Club

Of the Sporting Club the Principal is the President and two members of the teaching staff act as Vice-President and General Secretary respectively. As in the Students' Union the Vice-President and the General Secretary act as Faculty Advisers leaving the management of the affairs of the Sporting Club to the elected student Secretaries of the various sections which comprise

1. The Football Section.
2. The Cricket Section.
3. The Hockey Section.
4. The Tennis Section.
5. The Gymnasium Section.

All students are expected to make use of the sports facilities provided for keeping themselves fit amidst a heavy academic programme and for recreation.

The College Journal

The College Journal is a four monthly publication managed by an elected student body under the guidance of a Faculty Advisory Committee of which the Principal is the President and a member of the teaching staff is the Secretary.

A senior student is elected every year the Editor of the College Journal and is assisted by student sub-editors.

The 'Tech.'

The final year students publish every year a Year Book of their class called "TECH" containing life history and a photograph each, of the graduating students.

A Tech-Committee is elected every year from the final year classes and work under the guidance of a Tech Adviser who is the Chairman of the Committee.

(c) The Alumni Association :—

The Alumni Association is the Association of the "Old Boys" of the College. In addition to other activities directed to benefit the College the Loan Scholarship Fund for final year students of the College and the Placement Service may be specially mentioned. On the termination of their college career all students are eligible to be a member of the Association.

EXAMINATION RULES

1. Only those students of classes other than Engineering 1st and 2nd Year who have satisfactorily completed their practical work, satisfied the attendance requirements and paid all dues for the whole session, are eligible to sit for the examination.

2. At the end of each Academic Session, all students must appear at the Annual Examinations held by the National Council of Education, Bengal, in papers as stated in the Prospectus.

3. In addition to the above examination, every student shall, during each year of study, appear at three written Periodical Examinations in each theoretical paper. He shall also appear at Periodical Oral Examinations, if such are held.

4. All examinations will be held on "Compartmental System". Students must pass separately in every paper in the above examinations. A student who has passed the examination in any paper will not have to sit for examination in that paper again.

5. Every candidate will be declared to have passed the examination in any paper if he obtains—

- (a) 50 per cent of the total marks of Periodical Examinations in that paper, and

(b) 50 per cent of the marks at the Annual Examination. Provided that if a candidate fails to obtain pass marks either at the Periodical Examinations or at the Annual Examination, he may be credited with not more than 5 marks transferred from either part of the examination, in excess of the pass marks in the paper, in order to enable him to pass.

6. Students, who have passed the Final Engineering Examination, will be declared to have graduated (i) with First Class Honours if they have obtained at least 70 per cent marks on the average in the Periodical Examinations and at least 70 per cent marks on the average in the Annual Examinations in the Final Engineering papers and at least 70 per cent in practical class works of the Third and Fourth Year Classes, (ii) with Second Class Honours if they have obtained at least 60 per cent marks on the average in the Periodical Examinations and at least 60 per cent marks on the average in the Annual Examinations in the Final Engineering papers and at least 60 per cent in practical class works of Third and Fourth Year Classes provided always that they have passed in all the papers of the Final Engineering Examinations in the first chance.

7. Students who have passed the Post Graduate Examinations will be declared to have passed with First Class Honours if they have obtained at least 70 per cent marks on the average and with Second Class Honours if they have obtained at least 60 per cent marks on the average.

8. Students of the Diploma courses who fail to pass in not more than two papers will be promoted to the next higher class, but they will have to pass examinations in those papers before they can be promoted further.

9. Students, who have passed in all subjects of their regular year, but cannot be promoted in accordance with Rule 8 above, shall have to attend classes in those back-papers for the whole session and have to pass the Annual Examination in those papers, failing which they will not be allowed to continue their studies in this College any further. Such students will not be allowed to sit for the Supplementary Examinations in those papers.

10. If any student fails to get promotion to the next higher class he will be required to attend the classes and pay the regular tuition and other fees.

11. (i) Students of the 1st Year Classes who fail to get promotion to the next higher class on the result of the Annual Examinations will be allowed to study again the 1st Year Class for another session only and the students detained for two years in the 1st Year Classes will not be allowed to continue their studies in the College any further.

(ii) Students of the 2nd, 3rd and 4th Year Classes who have been detained in the same class for two years, will be allowed to appear at another Annual Examination as non-collegiate students by paying only the examination fees as current for the Supplementary Examination and such students need not be admitted into the College in that session and need not, therefore, pay tuition and other regular fees.

12. Students belonging to Engineering Third Year Classes, who have passed in all papers of the Intermediate Engineering Examination, will be promoted to the Engineering Fourth Year Classes with a maximum of three back-papers only.

13. Only those students of Final Year Classes, who fail to pass in not more than three papers of the Final Engineering Examination and in not more than two papers of the Final Examination of the Diploma Course, Final Overseer Course, and Final Agriculture Course, as the case may be, will be permitted to appear and pass in those papers in two subsequent and consecutive examinations, including Supplementary Examination, without attending the classes, provided they can satisfy the Authorities of the College that they are employed in some recognised firm. Intimation of such employment should reach the College on or before the 1st day of September of the year in which they completed the study of the Final Year Class. They will also have to register their names in the College by paying an enrolment fee of Rs. 10/- (Rupees ten) only and will have to pay a fee of Rs. 20/- (Rupees twenty) only for each examination they sit for. Students of this category not engaged in any factory will have to take admission in the College and attend classes and pay all fees for the session.

14. Students of the Final Year Classes, who fail to pass in more than three papers of the Final Engineering Examination and in more than two papers in the Final Examination of the Diploma Course, Final Overseer Course, and Final Agriculture Course as the case may be, will be required to attend the classes and pay regular tuition and other fees. They will have to pass in all remaining papers in the next Supplementary and Annual Examinations.

15. Those students who duly cleared their dues up to the end of the session and duly paid the examination fees, but owing to some

accident or unavoidable circumstances could not appear in any of the examinations of the Council, are allowed to appear in the next Annual Examination without attending the classes and without paying any further tuition fees, excepting the examination fees. But they will have to enrol their names for the classes with payment of a fee of Rs. 5/- (Rupees five) only within a month after the beginning of the session.

16. A Supplementary Examination will be held each year between two Annual Examinations for the benefit of the students who, having failed to pass in one or more subjects at the Annual Examination, are permitted to prosecute their studies in the next higher class. Such students can appear only in back-papers in the Supplementary Examinations.

17. Students shall pay examination fees as follows :

I. For Annual Examinations and examinations at the end of each semester :

(a) Post Graduate Courses :

Rs. 15/- per paper and Rs. 60/- for the thesis.

(b) Final Engineering Examinations :

Rs. 3/8/- per paper subject to a minimum of Rs. 10/-.

(c) All other examinations except Automobile Engineering :

Rs. 2/8/- per paper subject to a minimum of Rs. 10/-.

(d) Automobile Engineering Examination :

Rs. 17/8/-.

II. For Supplementary Examinations :

(a) Degree Courses :

Rs. 3/8/- per paper of Final Engineering and Rs. 2/8/- per paper for other examinations both subject to a minimum of Rs. 20/-.

(b) All other Courses :

Rs. 2/8/- per paper subject to a minimum of Rs. 15/-.

18. Examination fees once paid shall in no case be refunded.

19. Applications for re-examination of answer papers will not be entertained if submitted later than a week after the re-opening of the

College after the Summer Vacation. Those candidates who intend to have their papers re-examined may apply for the same with a fee of Rs. 5/- for each paper. Re-examination fees are never refundable.

20. No certificate will be issued by the Council on the results of any examinations except the Final. Degrees will be granted to students who pass the Final Examinations of the Post Graduate and Degree Courses and Certificates to students who pass the Final Examinations of other courses.

21. Annual Examination fees must be paid within 18th February every year. Supplementary Examination fees must be paid within 30th September every year.

Fifteen days' grace with a penalty of Rs. 5/- may be allowed at the discretion of the Controller of Examinations.

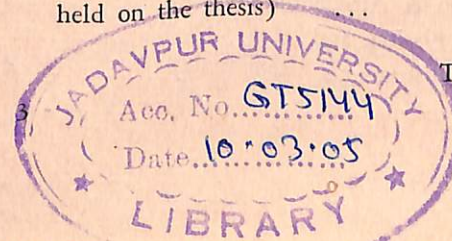
22. Examination rules for Engineering First and Second Year Classes are given under "Subjects of examination" of the respective classes.

PROGRAMME OF STUDY

I. POST GRADUATE COURSES

Chemical Engineering

		Full Marks
(i) Chemical Engineering Thermodynamics	One paper	100
(ii) Any two unit process : e.g., (a) Evaporation, (b) Distillation, (c) Absorption etc. (One written paper for each). A foreign language (German, French or Russian) may be taken in place of any one of these two	Two Papers	200
(iv) One of the elective subjects of the B.Ch.E. course which has not been taken by the student in his undergraduate course	One Paper	100
(v) Research work in any Chemical or Ch.E. Problem on which a thesis should be submitted. (An oral examination will be held on the thesis)	One Paper	100
Total	Five Papers	500



Electrical Engineering

The following three subjects are compulsory for all students :

	Full Marks
1. Higher Mathematics	One paper 100
2. Advanced Physics	One paper 100
3. Foreign Language	One paper 100

In addition to the above-mentioned subjects students are to take any *one* of the following subjects :

4. Electrical Machines	} One paper 100
5. Electric Power	
6. Electrical Communications	
7. (a) Symmetrical Components (b) Power System Measurements & Relaying	

Research Work

A thesis should be submitted on the research work and there will be an Oral Examination on the thesis

...	One paper 100
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Total Five papers 500

Mechanical Engineering

(i) & (ii) The students are to select any two of the following nine subjects :

1. Advanced Thermodynamics	} Two papers 200
2. Advanced Hydraulics	
3. Advanced Machine Tools	
4. Production Engineering	
5. Power Plant Engineering	
6. Internal Combustion Engine	
7. Refrigeration & Air-Conditioning	
8. Heat Transmission, and	
9. Measuring Instruments	

One foreign language (German, French or Russian) may be taken in place of any one of the above two subjects. A written paper shall be set on each selected subject. Further, each student shall have to appear in written examinations on the two following subjects :

(iii) Higher Mathematics One paper 100

(iv) Advanced Technical Mechanics One paper 100

(v) In addition to these subjects a piece of Research is to be done by each student and a thesis is to be submitted on the same. There will be an oral examination on the thesis. One paper 100

Total Five Papers 500

The examination will be on the compartment system and will be held once a year along with the Annual Examinations. The thesis on the research work may not be finished in one year in all cases but that will not debar the students from sitting for examination in the theoretical papers. They may continue their research work and prepare the thesis after the written examination in such cases. The students will be entitled to the Master's Degree on fulfilment of all the conditions (*i.e.* passing in the four papers and the Thesis). As long as they do not fulfil these conditions they will have to remain as students and pay the usual tuition fees.

There will be no observance of percentage in attendance, and the minimum pass marks shall be 50%.

II. ENGINEERING COURSES

(1) FIRST YEAR CLASS

Students who are admitted to the First Year Class of the Electrical, Mechanical and Chemical Engineering Courses after passing the I.Sc. or B.Sc. examinations of any recognised University, study the following subjects in the Engineering First Year Class :

Electrical and Mechanical Engineering

First Semester (15th July to 30th November)—14 weeks.

SUBJECTS OF INSTRUCTION			PERIODS PER WEEK	
			Theoretical	Practical
M. 1	Co-ordinate Geometry	...	4	—
M. 2A	Differential Calculus	...	4	—
P. 1	Physics (Heat, Light and Sound)		4	—
G. 1	English	...	2	—
E. M. 1	Engineering Mechanics I	...	4	—
D. 1	Drawing	...	—	6
D. 2	Descriptive Geometry	...	—	3
W. 1	Carpentry & Moulding	...	—	3
P. 1A	Physics Laboratory	...	—	4
Total ...			18	16

Second Semester (1st January to 15th April)—12 weeks.

SUBJECTS OF INSTRUCTION			PERIODS PER WEEK	
			Theoretical	Practical
M. 2B	Integral Calculus	...	4	—
P. 2	Physics (Electricity & Magnetism)	...	4	—
E. M. 1	Engineering Mechanics I	...	4	—
O. 1	Survey	...	2	—
G. 2	Modern World I	...	2	—
D. 1	Drawing	...	—	6
D. 2	Descriptive Geometry	...	—	3
W. 1	Carpentry & Moulding	...	—	3
P. 1A	Physics Laboratory	...	—	4
	Practical Survey	...	—	3
Total ...			16	19

Chemical Engineering

First Semester (15th July to 30th November)—14 weeks

SUBJECTS OF INSTRUCTION			PERIODS PER WEEK	
			Theoretical	Practical
M. 1	Co-ordinate Geometry	...	4	—
M. 2A	Differential Calculus	...	4	—
P. 1	Physics (Heat, Light and Sound)		4	—
G. 1	English	...	2	—
E. M. 1	Engineering Mechanics I	...	4	—
Ch. 2	Inorganic Chemistry I	...	3	—
D. 1	Drawing	...	—	6
P. 1A	Physics Laboratory	...	—	4
Ch. 2A	Qualitative Analysis	...	—	9
Total ...			21	19

Second Semester (1st January to 15th April) 12 weeks.

SUBJECTS OF INSTRUCTION			PERIODS PER WEEK	
			Theoretical	Practical
M. 2B	Integral Calculus	...	4	—
P. 2	Physics (Electricity and Magnetism)	...	3	—
E. M. 1	Engineering Mechanics I	...	4	—
Ch. 2	Inorganic Chemistry I	...	3	—
Ch. 3	Organic Chemistry I	...	6	—
G. 2	Modern World I	...	2	—
D. 1	Drawing	...	—	6
P. 1A	Physics Laboratory	...	—	4
Ch. 2A	Qualitative Analysis	...	—	9
Total ...			22	19

SUBJECTS OF EXAMINATION

I. ENGINEERING COURSES

(1) FIRST YEAR CLASS

Students of the First year classes, who have completed the programme of study offered in the first semester will be allowed to appear in the following papers of the First Engineering Examinations of the National Council of Education, Bengal, held annually at the end of first semester, in the month of December.

First Semester Examination

(1) *Electrical and Mechanical Engineering*

SUBJECT	No. OF PAPERS	FULL MARKS
1. English	...	100
2. Co-ordinate Geometry	...	100
3. Differential Calculus	...	100
4. Heat, Light and Sound	...	100
	4	400

(2) *Chemical Engineering*

SUBJECT	No. OF PAPERS	FULL MARKS
1. English	...	100
2. Co-ordinate Geometry	...	100
3. Differential Calculus	...	100
4. Heat, Light and Sound	...	100
	4	400

Students of the First Year Classes who have completed the programme of study offered in the second semester and have obtained at least 50 per cent marks in each of the practical subjects of instruction (which includes also any tutorial work) offered during the academic year will be allowed to appear in the following papers of the First Engineering Examination of the National Council of Education, Bengal, held annually at the end of second semester in the month of April and May.

Students who fail to complete their class works satisfactorily will not be allowed to sit in the examination but they will be allowed to sit in the next supplementary examination if they complete the unfinished class works in the intervening period.

Second Semester Examination

(1) *Electrical and Mechanical Engineering*

SUBJECT	No. OF PAPERS	FULL MARKS
1. Modern World I	...	100
2. Integral Calculus	...	100
3. Electricity and Magnetism	...	100
4. Engineering Mechanics I	...	100
5. Survey	...	100
6. Drawing (6 hours)	1 (Practical)	100
7. Descriptive Geometry (3 hours)	1 "	100
8. Physics Laboratory	1 "	100
	8	800

(2) *Chemical Engineering*

SUBJECT	No. OF PAPERS	FULL MARKS
1. Modern World I	...	100
2. Inorganic Chemistry I	...	100
3. Organic Chemistry I	...	100
4. Integral Calculus	...	100
5. Electricity and Magnetism	...	100
6. Engineering Mechanics I	...	100
7. Drawing (6 hours)	1 (Practical)	100
8. Physics Laboratory	1 "	100
	8	800

Students, who have passed in all papers of the First Engineering Examinations subject to rules 3 and 5 of Examination Rules are promoted to the Engineering Second Year Class.

For the benefit of the students who have failed to get promotion to the Second Year Class due to their being absent or being unable to secure pass mark in one or more papers of the examination held

at the end of First and, or Second Semesters, a Supplementary Examination will be held in the First week of July. Students passing in this examination will also be promoted to the Second Year Class. Those students who cannot secure promotion will be given one more chance to clear the paper or papers in the supplementary examination held at the end of the next session as non-collegiate students. They will have to pay only examination fees but no tuition fees.

PROGRAMME OF STUDY

II. ENGINEERING COURSES

(2) SECOND YEAR CLASSES

Students, who have been promoted from the First Year Class, study the following subjects in the second Year Classes :

Electrical and Mechanical Engineering

First Semester (14 weeks) 15th July to 30th November

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
M. 3	Integral Calculus and Differential Equations ...	4	—
E. E. 1	Principles of Electrical Engineering I	3	—
E. E. 2	Electrical Wiring and Installations	2	—
E. E. 3	Direct Current Machines ...	4	—
E. M. 2	Engineering Mechanics II ...	3	—
M. E. 1	Engineering Thermodynamics	3	—
G. 3	Modern World II ...	2	—
M. E. 19	Machine Drawing ...	—	6
E. M. 9	Engineering Computation ...	—	4
E. E. 22	Electrical Engineering Laboratory I	—	3
W. 2	Patterns and Forging ...	—	3
W. 3	Fitters' shop ...	—	3
Total ...		21	19

Second Semester (12 weeks) 1st January to 15th April

SUBJECTS OF INSTRUCTION		Theoretical PERIODS PER WEEK		Practical
E. M. 8	Engineering Materials and Processes ...	4	—	—
M. E. 1	Engineering Thermodynamics	3	—	—
M. E. 2	Mechanism ...	4	—	—
E. M. 2	Engineering Mechanics II ...	3	—	—
E. E. 1	Principles of Electrical Engineering I ...	3	—	—
M. E. 19	Machine Drawing ...	—	6	—
E. E. 22	Electrical Engineering Laboratory I ...	—	3	—
W. 2	Patterns and Forging ...	—	3	—
W. 3	Fitters' Shop ...	—	3	—
E. M. 7	Mechanism Drawing ...	—	4	—
Total ...		17	19	—

Chemical Engineering

First Semester (14 weeks) 15th July to 30th November

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
Ch. 4	Inorganic Chemistry II ...	4	—
Ch. 6	Physical Chemistry I ...	3	—
M. 3	Integral Calculus & Diff. Equation ...	4	—
M. E. 3	Heat Engines ...	4	—
E. E. 17	Electrical Engineering ...	3	—
G. 3	Modern World II ...	2	—
M. E. 19	Machine Drawing ...	—	6
Ch. 4A, Ch. 5A & Ch. 11A	Chemistry Laboratory ...	—	12
Total ...		20	18

Second Semester (12 weeks) 1st January to 15th April

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
E. M. 3	Engineering Mechanics	...	6
Ch. 6	Physical Chemistry I	...	3
Ch. 5	Organic Chemistry II	...	6
E. E. 17	Electrical Engineering	...	3
M. E. 19	Machine Drawing	...	—
E. E. 17A	Electrical Engineering Laboratory	—	6
Ch. 4A, Ch. 5A			3
& Ch. 11A	Chemistry Laboratory	...	—
		—	12
Total		...	18
			21

SUBJECTS OF EXAMINATION

II. ENGINEERING COURSES

(2) SECOND YEAR CLASS

Students of the Engineering Second Year Classes, who have completed the programme of study offered in the first semester will be allowed to appear in the following papers of the Intermediate Engineering Examination of the National Council of Education, Bengal, held annually at the end of the First Semester, in the month of December.

First Semester Examination

Electrical and Mechanical Engineering

SUBJECTS	No. OF PAPERS	FULL MARKS
1. Integral Calculus and Differential Equation	...	1
2. Modern World II	...	1
3. Direct Current Machines	...	1
4. Electric Wiring and Installations	...	1
	—	—
	4	400

Chemical Engineering

SUBJECTS	No. OF PAPERS	FULL MARKS
1. Integral Calculus and Differential Equation	...	1
2. Modern World II	...	1
3. Heat Engines	...	1
4. Inorganic Chemistry II	...	1
	—	—
	4	400

Students of the Engineering Second Year Classes who have completed the programme of study offered in the Second Semester and have obtained at least 50 per cent marks in each of the practical subjects of instruction (which includes also any tutorial work) offered during the academic year, will be allowed to appear in the following papers of the Intermediate Engineering Examination of the National Council of Education, Bengal, held annually at the end of the Second Semester in the month of April and May.

Students, who fail to complete their class works satisfactorily, will not be allowed to sit in this examination, but they will be allowed to sit in the next supplementary examination if they can complete the unfinished class works in the intervening period.

Second Semester Examination

Electrical and Mechanical Engineering

SUBJECTS	No. OF PAPERS	FULL MARKS
1. Engineering Materials and Processes	1	100
2. Engineering Thermodynamics	...	1
3. Mechanism	...	1
4. Engineering Mechanics II	...	1
5. Principles of Electrical Engineering I	1	100
6. Machine Drawing (6 hours)	...	1 (Practical)
	—	—
	6	600

Chemical Engineering

SUBJECTS	NO. OF PAPERS	FULL MARKS
1. Engineering Mechanics	... 1	100
2. Organic Chemistry II ...	... 1	100
3. Physical Chemistry ...	... 1	100
4. Electrical Engineering	... 1	100
5. Machine Drawing (6 hours)	... 1 (Practical)	100
	5	500

Students, who have passed in all papers of the Intermediate Engineering Examinations subject to rules 3 and 5 of Examination Rules are promoted to the Engineering Third Year Class.

For the benefit of the students who have failed to get promotion to the Third Year Class due to their being absent or being unable to secure pass mark in one or more papers of the examination held at the end of First and, or, Second Semester, a supplementary examination will be held in the first week of July. Students passing in this examination will also be promoted to the Third Year Class. Those students, who cannot secure promotion due to failing to get pass mark or being absent in one or more papers, will be given one more chance to clear the paper or papers in the supplementary examination held at the end of the next session as non-collegiate students. They will have to pay only examination fees but no tuition fees.

No student will be allowed to sit for any paper in the supplementary examination if he has not completed all class works satisfactorily. If a student is debarred from appearing in the Supplementary Examination held at the end of the Second Semester, due to incomplete class works, he will be given one more chance to attend the classes and will have to take admission in the College by paying readmission fee and attend regularly for the whole session those practical classes in which his progress was not satisfactory. He shall have to pay the full tuition and other fees. On satisfactory completion of class works (which means securing at least 50 per cent marks) he will be allowed to sit for the Annual Examination held at the end of the Second Semester

as well as in the Supplementary Examination if need be. If he fails to clear all papers in these two successive examinations he will not be allowed to study in the College any further. It should be noted that class work includes tutorial works in any subject when such are held.

This rule apply to both First and Second Year Engineering Classes.

PROGRAMME OF STUDY**II. ENGINEERING COURSES****(3) THIRD YEAR CLASS**

Students, who have been promoted from the Second Year Classes, study the following subjects in the Third Year Classes :

Chemical Engineering

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
E. M. 5	Strength of Materials	... 3	—
Ch. 7	Physical Chemistry II	... 2	—
Ch. 8	Electrochemistry	... 3	—
Ch. 11	Industrial Chemistry I	... 2	—
Ch. 12	Metallurgy ...	... 2	—
Ch. 10	Chemical Engineering I	... 3	—
Ch. 13	Fuels & Their Combustion	... 2	—
Ch. 10A	Industrial & Chemical Engineering Calculations I	... 2	—
Ch. 9, Ch. 11A	Physico-Chemical Measurements	—	18*
Ch. 11A, Ch. 5A	Technical Analysis	... —	18*
M. E. 9C	Machine Drawing & Design	... —	3
		—	—
	Total	... 19	21

Electrical Engineering

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
E. M. 5	Strength of Materials	... 3	—
M. E. 8	Hydraulics ...	... 2	—
M. E. 7	Prime Movers ...	... 3	—
E. E. 5	Differential Equations & Operational Calculus	... 2	—

* For half year.

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
E. E. 6	Alternating Current Machines I	4	—
E. E. 4	Principles of Electrical Engineering II	2	—
E. E. 4A	Electron Tubes and Circuits I	1	—
E. E. 8	Electrical Measuring Instruments & Measurements	3	—
E. E. 21	Electrical Engineering Calculations	—	2
E. E. 19	Electrical Drawing & Design	—	3
E. E. 23	Electrical Engineering Laboratory II	—	3
M. E. 9B	Machine Drawing & Design	—	5
M. E. 21B	Mechanical Engineering Laboratory	—	3
W. 4A	Machine Shop	—	3
Total		20	19

Mechanical Engineering

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
E. M. 4	Strength of Materials and Theory of Structures	4	—
M. E. 8	Hydraulics	2	—
M. E. 9	Theory of Machine Design	2	—
M. E. 4	Steam Engines & Boilers	4	—
M. E. 5	Steam Turbine	2	—
M. E. 6	Internal Combustion Engines	2	—
E. E. 16	A.C. Machine & Power Distribution	3	—
M. E. 9A	Machine Drawing & Design	—	8
M. E. 21A	Mechanical Engineering Laboratory	—	6
E. E. 23A	Electrical Engineering Laboratory	—	3*
W. 4	Workshop Practice—Machineshop	—	6
Total		19	20

* For half year instead of M. E. 21A.

SUBJECTS OF EXAMINATION

II. ENGINEERING COURSES

(3) THIRD YEAR CLASS

Students of the Engineering Third Year Classes, who have completed the above programme of study and have obtained at least 50 per cent marks in the Practical Subjects of Instruction, are allowed to appear in the following subjects of the Final Engineering Examination of the National Council of Education, Bengal, held annually at the end of the Academic Session :

Chemical Engineering

SUBJECT	NO. OF PAPERS	FULL MARKS
Strength of Materials	1	100
Physical Chemistry II	1	100
Electro-Chemistry	1	100
Industrial Chemistry I	1	100
Metallurgy	1	100
Fuels & their Combustion	1	100
Industrial & Chemical Engineering Calculations I	1	100
Machine Drawing & Design (6 hours)	1	100
		800

Electrical Engineering

SUBJECT	NO. OF PAPERS	FULL MARKS
Strength of Materials	1	100
Hydraulics	1	100
Prime Movers	1	100
Differential Equations & Operational Calculus	1	100
Alternating Current Machines I	1	100
Principles of Electrical Engineering II	1	100
Electrical Measuring Instruments & Measurements	1	100
Electron Tubes & Circuits I	1	100
Machine Drawing & Design (6 hours)	1	100
		900

Mechanical Engineering

SUBJECT	NO. OF PAPERS	FULL MARKS
Strength of Materials and Theory of Structures	1	100
Hydraulics	1	100
Theory of Machine Design	1	100
Steam Engines & Boilers	1	100
Steam Turbines	1	100
Internal Combustion Engines	1	100
A.C. Machines & Power Distribution	1	100
Machine Drawing & Design (6 hours)	1	100
		800

Students, who have passed in all subjects of the above Examination, subject to Rules 3 and 5 of the Examination Rules, are promoted to the Engineering Fourth Year Classes, provided they have also passed in all subjects of the Intermediate Engineering Examination and have satisfactorily completed a factory training of three months, to be arranged for by the College.

Students, who have passed in all subjects of the Intermediate Engineering Examination and have got plucked in not more than three of the above subjects of the Final Engineering Examination, will also be promoted to the Engineering Fourth Year Classes, provided they have satisfactorily completed three months' factory training to be arranged for by the College. They will, however, have to pass in those subjects of the Third Year Class in which they failed to secure pass marks before they can be granted the Degree at the end of the Course.

Practical training of the Third Year students of the Mechanical, Electrical and Chemical Engineering Courses will be treated as a special subject carrying 100 marks with special proviso that (a) the minimum number of days of attendance for practical training is 70 days and (b) Trainee should secure at least 50% marks on their training records.

PROGRAMME OF STUDY

II. ENGINEERING COURSES

(4) ENGINEERING FOURTH YEAR CLASS

Students, who have been promoted from the Engineering Third Year Classes, study the following subjects in the Fourth Year Classes :

Chemical Engineering

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
Ch. 14	Chemical Engineering II	4	—
Ch. 15	Industrial Chemistry II	2	—
Ch. 14A	Industrial & Chemical Engineering Calculations II	2	—
G. 4	Engineering Economics	2	—
Ch. 16	Chemical Engineering Laboratory	—	14*
W. 4A	Machine Shop	—	3
<i>Electives :</i>			
<i>Any one of the following three :</i>			
Ch. 17	Chemical Technology of Oils & Fats	3	6
Ch. 18	Glass Technology	3	
Ch. 19	Food Technology	3	
Total		13	23

Electrical Engineering

(Power Engineering option)

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
M. E. 24	Power Plant & Boiler	2	—
E. E. 7	A. C. Machines II (From 1951-52)	2	—
E. E. 10	Electric Power Transmission	2	—
E. E. 11	Electric Power Generation	2	—
E. E. 12	Power Utilization & Traction	2	—
E. E. 13	Electrical Measurements	2	—
(For 1950-51 only)			

* Students are required to work in the Mechanical Engineering Laboratory M. E. 21C for eight weeks as part of the work in Ch. 16.

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
E. E. 14	Elements of Communications and Applied Electronics ...	3	—
E. E. 9	Electric Power Distribution ...	2	—
G. 4	Engineering Economics ...	2	—
G. 5	General Geology ...	2	—
E. E. 24	Electrical Engineering Laboratory III ...	—	6
E. E. 20	Electrical Project & Design ...	—	6
E. E. 25	Electrical Workshop ...	—	3
E. E. 26	Abstract ...	—	2
E. E. 18	Electrical Drawing ...	—	3
	Total ...	19	20

(Communication Engineering Option)

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
(1st Term : Aug.-Nov.)			
E. E. 15.1	Electron Tubes and Circuits :		
	Recitations ...	4	—
	Computations ...	—	3
E. E. 15.7	Electronics Laboratory ...	—	3
E. E. 15.2	Basic Communication Systems ...	2	—
E. E. 15.3	Communication Networks :		
	Recitations ...	3	—
	Computations ...	—	3
E. E. 15.8	Electronic Equipment Shop I ...	—	3
	Total ...	9	12

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
2nd Term : Dec.-March)			
E. E. 15.4	Radio and Communication Theory :		
	Recitations ...	4	—
	Computations ...	—	4
E. E. 15.6	Telephone and Telegraph Systems ...	2	—
E. E. 15.5	Ultrahigh Frequency Techniques ...	3	—
E. E. 15.9	Radio & Communication Laboratory ...	—	6

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
(1st Term : Dec.-March)			
E. E. 15.10	Electronic Equipment Shop II ...	—	3
E. E. 15.11	Seminar ...	—	2
	Total ...	9	15
(Throughout the year)			
E. E. 10	Electric Power Transmission ...	2	—
G. 4	Engineering Economics ...	2	—
	French or German (General Study) ...	2	—
	Total : 1st Term ...	15	12
	2nd Term ...	15	15

Mechanical Engineering

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
E. M. 6	Technical Dynamics ...	2	—
M. E. 11	Power Plant Engineering ...	2	—
M. E. 16	Factory Organization & Management ...	2	—
M. E. 15	Mechanical Handling of Materials ...	2	—
M. E. 14	Materials of Construction ...	1	—
M. E. 13	Machine Tools ...	2	—
G. 4	Engineering Economics ...	2	—
G. 5	General Geology ...	2	—

Electives :

*Any two of the following
six Subjects :*

G. 6	Engineering Geology	... 2
M. E. 17	Refrigeration	... 2
M. E. 18	Air Conditioning	... 2
M. E. 12	Motor car Engineering	2
M. E. 10	Hydraulic Machines & Water Power	... 2
M. E. 23	Railway Engineering Mechanical	... 2
	<i>or</i>	
	<i>the following two :</i>	
M. E. 25	Quantity Production methods	... 2
M. E. 26	Production Planning	... 2

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
W. 4	Advanced Workshop Practice	—	6
M. E. 21A	Mechanical Engineering Laboratory	...	3
M. E. 20	Machine Design	...	9
M. E. 22	Abstract	...	2
Total		19	20

SUBJECTS OF EXAMINATION

II. ENGINEERING COURSES

(4) FOURTH YEAR CLASS

Students of the Engineering Fourth Year Classes, who have completed the above Programme of Study and have obtained at least 50 per cent marks in the Practical Subjects of Instruction, are allowed to appear in the Final Engineering Examination of the National Council of Education, Bengal, held annually at the end of the Academic Session in the following remaining subjects of that Examination :

Chemical Engineering

SUBJECT			NO. OF PAPERS	FULL MARKS
Chemical Engineering I	...	...	1	100
Chemical Engineering II	...	...	1	100
Industrial Chemistry II	...	...	1	100
Industrial and Chemical Engineering Calculation II	...	...	1	100
Engineering Economics	...	...	1	100
Chemical Engineering Design	...	...	—	100
General knowledge in Chemistry and Chem. Engineering	...	...	1 (oral)	100
<i>Electives :</i>				
Chemical Technology of Oils & Fats		}	1	100
or				
Glass & Ceramic Technology	...			
or				
Food Technology	...			
				800

Electrical Engineering

(Power Engineering option)

SUBJECT	NO. OF PAPERS	FULL MARKS
Power Plant & Boiler	1	100
Electric Power Transmission	1	100
Power Utilisation & Traction	1	100
Electric Power Generation	1	100
Electrical Measurements (for 1950-51 only)	1	100
Elements of Communications and Applied Electronics	1	100
General Study	1	100
Engineering Economics	1	100
Electrical Engineering Laboratory (oral)	1	100
Electric Power Distribution	1	100
A. C. Machines II (from 1951-52)	1	100
		1000

(Communication Engineering Option)

SUBJECT	NO. OF PAPERS	FULL MARKS
1. At the end of the 1st Term in November :		
E. E. 15.1 Electron Tubes and Circuits	1	100
E. E. 15.2 Basic Communication Systems	1	100
E. E. 15.3 Communication Networks	1	100
2. At the end of the 2nd Term in March :		
E. E. 15.4 Radio and Communication Theory	1	100
E. E. 15.6 Telephone and Telegraph Systems	1	100
E. E. 15.5 Ultra-high Frequency Techniques	1	100
E. E. 10 Electric Power Transmission	1	100
G. 4 Engineering Economics	1	100
General Study	1	100
Electrical Engineering Laboratory (Oral)	1	100
		1000

Mechanical Engineering

SUBJECT		NO. OF PAPERS	FULL MARKS
Power Plant Engineering	...	1	100
Factory Organisation & Management	...	1	100
Mechanical Handling of Materials	...	1	100
Materials of Construction	...	1	100
Machine Tools	...	1	100
General Study (General Geology)	...	1	100
Engineering Economics	...	1	100
Advanced Workshop Practice (oral)	...	1	100
Mechanical Engineering Laboratory (oral)		1	100
Technical Dynamics	...	1	100

Electives: Any two of the following:

Engineering Geology	...	1	100	}	2	200
Refrigeration	...	1	100			
Air Conditioning	...	1	100			
Motor Car Engineering	...	1	100			
Hydraulic Machines & Water Power	...	1	100			
Railway Engineering Mechanical		1	100			
<i>or</i>						
<i>the following two :</i>						
Quantity Production Methods	1		100	}		
Production Planning	...	1	100			

1200

Students, who have passed in all subjects of the Final Engineering Examinations, subject to Rules 3 and 5 of the Examination Rules, held at the end of the Third and Fourth Year Classes, are granted Degree in Chemical, Electrical or Mechanical Engineering, as the case may be, by the National Council of Education, Bengal.

The students, who have obtained the B.M.E. Degree and want to obtain B.E.E. Degree, are to study the following subjects in their Electrical Engineering 3rd and 4th Year Classes respectively :—

Subjects for Electrical Engineering Third Year Class

1. Differential Equations & Operational Calculus.
2. Alternating Current Machines—I.
3. Principles of Electrical Engineering—II
4. Electrical Engineering Calculation.
5. Electrical Drawing & Design.
6. Electrical Engineering Laboratory.
7. Electrical Measuring Instruments & Measurements.

Subjects for Electrical Engineering Fourth Year Class

1. Electrical Power Transmission.
2. Power Utilization & Traction.
3. Electrical Power Generation.
4. A. C. Machines—II.
5. Elements of Communication and Applied Electronics.
6. Electrical Power Distribution.
7. Electrical Engineering Laboratory—III.
8. Electrical Project & Design.
9. Electrical Workshop.
10. Abstract.
11. Electrical Drawing.

The students, who have obtained the degree of B.E.E. and want to obtain B.M.E. degree are to study the following subjects in their 3rd and 4th year classes respectively.

Subjects for Mechanical Engineering Third Year Class

1. Strength of Materials & Theory of Structures.
2. Theory of Machine Design.

3. Steam Engine & boiler.
4. Steam Turbines.
5. Internal Combustion Engines.
6. Machine Drawing & Design.
7. Mechanical Engineering Laboratory.
8. Workshop Practice—Machine shop.

Subjects for Mechanical Engineering Fourth Year Class

1. Technical Dynamics.
2. Power Plant Engineering.
3. Factory Organization & Management.
4. Mechanical Handling of Materials.
5. Materials of Construction.
6. Machine Tools ; and
7. & 8. Any two of the following six subjects :—

1. Engineering Geology.
2. Refrigeration.
3. Air Conditioning.
4. Motor Car Engineering.
5. Hydraulic Machine & Water Power Engineering.
6. Railway Engineering Mechanical.

or

the following two :

1. Quantity Production Methods.
2. Production Planning.
9. Advanced Workshop Practice.
10. Mechanical Engineering Laboratory.
11. Machine Design.
12. Abstract.

PROGRAMME OF STUDY

DIPLOMA COURSE IN ENGINEERING

FIRST YEAR CLASS

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
D. G. 1	English ...	1	—
D. M. 1	Algebra & Trigonometry ...	4	—
D. P. 1	Physics ...	4	—
D. Ch. 1	Chemistry ...	2	—
D. P. 3	Physics Laboratory ...	—	2
D. Ch. 1A	Chemical Laboratory ...	—	2
D. D. 1	Drawing ...	—	9
D. W. 1	Carpentry ...	—	6
D. W. 1	Moulding ...	—	6
	Physical Training ...	—	2
		—	—
Total ...		11	27

SECOND YEAR CLASS

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
D. M. 2	Practical Mathematics ...	3	—
D. P. 2	Physics ...	3	—
D. Ch. 2	Chemistry ...	2	—
D. E. E. 1	Electrical Engineering ...	2	—
D. E. M. 1	Mechanics & Mechanism ...	3	—
D. G. 2	Business English ...	2	—
D. P. 4	Physics Laboratory ...	—	2
D. D. 2	Drawing ...	—	6
D. W. 2	Forging ...	—	6
D. W. 2	Pattern Shop ...	—	6
		—	—
Total ...		15	20

THIRD YEAR CLASS

SUBJECTS OF INSTRUCTION	PERIODS PER WEEK	
	Theoretical	Practical
D. E. E. 2 Electrical Engineering I	... 2	—
D. E. E. 3 Electrical Engineering II	... 2	—
D. M. E. 1A Heat Engines	... 2	—
D. M. E. 1B Boilers, Pumps & Auxiliary Machines ...	... 2	—
D. E. M. 2 Applied Mechanics	... 3	—
D. D. 3 Drawing ...	... —	9
D. E. E. 4 Electrical Engineering Laboratory ...	... —	3
D. M. E. 2 Power House Practice	... —	3
D. W. 3 Machine Shop ...	... —	6
D. W. 3 Fitting Shop	... —	6
	—	—
Total ...	11	27

Students, who have completed the above Programme of Study and have obtained at least 50 per cent marks in the Practical Subjects of Instruction, are allowed to appear in the Annual Examinations of the respective classes held at the end of the Academic Session by the National Council of Education, Bengal.

SUBJECTS OF EXAMINATION

DIPLOMA COURSE IN ENGINEERING

Annual Examination at the end of the First Year Class

SUBJECT	NO. OF PAPERS	FULL MARKS
Theoretical :—		
Algebra & Trigonometry	... 1	100
Physics (General Properties, Light, Sound & Elements of Electricity)	... 1	100
Chemistry	... 1	100
English	... 1	100
Drawing	... 1	100

SUBJECT	NO. OF PAPERS	FULL MARKS
Practical :		
Carpentry	... —	100
Moulding	... —	100
		700

Students, who pass in all subjects of the above Examination subject to Rules 3 and 5 of the Examination Rules are promoted to the Diploma Course in Engineering Second Year Class.

Students, who fail to pass in not more than two papers in the above Examination will be promoted to the Diploma Course in Second Year Class, but they will have to pass examinations in those papers before they can be further promoted.

Annual Examination at the end of the Second Year Class

SUBJECT	NO. OF PAPERS	FULL MARKS
Theoretical :—		
Practical Mathematics	... 1	100
Physics (Heat, Electricity & Magnetism)	1	100
Chemistry	... 1	100
Mechanics & Mechanism	... 1	100
Electrical Engineering	... 1	100
Business English	... 1	100
Drawing	... 1	100
Practical :—		
Forging	... —	100
Pattern making	... —	100
		900

Students, who pass in all subjects of the above Examination subject to Rules 3 and 5 of the Examination Rules are promoted to the Diploma Course in Engineering Third Year Class.

Students, who fail to pass in not more than two papers in the above Examination will be promoted to the Diploma Course in Engineering Third Year Class, but they will have to pass examinations in those papers before they can be granted Diploma by the National Council of Education, Bengal.

Final Examination at the end of the Third Year Class

SUBJECT	NO. OF PAPERS	FULL MARKS
Theoretical :—		
Heat Engines ...	1	100
Boiler, Pumps & Auxiliary machines ...	1	100
Applied Mechanics ...	1	100
Electrical Engineering I ...	1	100
Electrical Engineering II ...	1	100
Drawing (6 hours) ...	1	100
Practical :—		
Machine shop (6 hours) ...	—	100
Fitters' shop (6 hours) ...	—	100
Electric wiring (6 hours) ...	—	100
		900

Students, who have passed in all subjects of the Final Examination of Diploma Course in Engineering subject to Rules 3 and 5 of the Examination Rules held at the end of the Third Year Class, are granted Diploma by the National Council of Education, Bengal, provided that they have passed in all subjects of the Second Year Class as well.

III. OVERSEER COURSE

(Three Years' Course)

PROGRAMME OF STUDY

First Year

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
O. M. 1	Trigonometry & Mensuration ...	4	—
O. S. P. 1	Elementary Physics ...	4	3
O. S. E. M. 1	Applied Mechanics I ...	3	—
O. S. 1	Surveying I ...	2	—
O. S. 4	Civil Engineering I ...	4	—
O. S. 11	Drawing I ...	—	12
O. S. 14	Office Work I ...	—	6
O. S. 16	Practical Survey I ...	—	4 to 6 weeks
		—	—
Total	...	17	21

Students are required to do field-work whole day in the months of November and December.

Second Year

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
O. S. E. M. 2	Applied Mechanics II ...	3	—
O. S. 2	Surveying II ...	2	—
O. S. 5	Civil Engineering II ...	4	—
O. S. 7	Highways & Irrigation ...	4	—
O. S. 8	Estimates & Specification I ...	4	—
O. S. 3A	Principles of Surveying Instru- ments ...	2	—
O. S. 12	Drawing II ...	—	12
O. S. 15	Office Work II ...	—	6
O. S. 17	Practical Survey II ...	—	4 to 6 weeks
		—	—
Total	...	19	18

Third Year

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
O. S. 10	Sanitary Engineering ...	4	—
O. S. 3	Surveying III ...	3	—
O. S. 6	Civil Engineering III ...	4	—
O. S. M. E. 1	Elementary Mechanical Engi- neering ...	3	—
O. S. E. E. 1	Elementary Electrical Engineering ...	3	—
O. S. 9	Estimates & Specification II ...	2	—
O. S. 13	Drawing & Design ...	—	12
O. S. E. E. 2	E. E. Laboratory ...	—	3
O. S. 18	Practical Survey II ...	—	4 to 6 weeks
O. S. M. E. 2	M. E. Laboratory ...	—	3
		—	—
Total	...	19	18

Students, who have completed the above Programme of Study and have obtained at least 50 per cent marks in the Practical subjects of Instruction, are allowed to appear in the Annual Examination of the respective classes held at the end of the Academic Sessions by the National Council of Education, Bengal.

SUBJECTS OF EXAMINATION

Annual Examination at the end of the First Year Class

SUBJECT	PAPERS NO. OF	MARKS FULL
Theoretical :—		
Trigonometry & Mensuration	... 1	100
Elementary Physics	... 1	100
Applied Mechanics I	... 1	100
Surveying I	... 1	100
Civil Engineering I	... 1	100
Drawing I (6 hours)	... 1	200
Practical & Class Works :—		
Physics Laboratory	... 1	100
Office Work	... 1	100
Class Drawing	... 1	200
Practical Survey	... 1	100
		1200

Students, who pass in all subjects of the above Examination subject to Rules 3 and 5 of the Examination Rules, are promoted to the Overseer Second Year Class.

Students, who fail to pass in not more than two papers in the above Examination, will be promoted to the Overseer Second Year Class, but they will have to pass examination in those papers before they can be further promoted.

Annual Examination at the end of the Second Year Class

SUBJECT	No. OF PAPERS	FULL MARKS
Theoretical :—		
Applied Mechanics II	... 1	100
Surveying II	... 1	100
Civil Engineering II	... 1	100
Highways & Irrigation	... 1	100
Estimates & Specifications I	... 1	100
Drawing II (6 hours)	... 1	200
Principles of Survey Instruments	... 1	100

SUBJECT	No. OF PAPERS	FULL MARKS
Practical & Class Works :—		
Class Drawing	... —	200
Office Works	... —	100
Practical Survey	... —	100
		1200

Students, who pass in all subjects of the above Examination, subject to Rules 3 and 5 of the Examination Rules, are promoted to the Overseer Third Year Class.

Students, who fail to pass in not more than two papers in the above Examination, will be promoted to the Overseer Third Year Class, but they will have to pass examinations in those papers before they can be granted Certificate by the National Council of Education, Bengal.

Final Examination at the end of the Third Year Class

SUBJECT	No. OF PAPERS	FULL MARKS
Theoretical :—		
Sanitary Engineering	... 1	100
Surveying III	... 1	100
Civil Engineering III	... 1	100
Elementary Mechanical Engineering	... 1	100
Elementary Electrical Engineering	... 1	100
Drawing & Design (6 hours)	... 1	200
Estimates & Specifications II	... 1	100
Practical & Class Works :—		
E. E. Laboratory	... —	100
M. E. Laboratory	... —	100
Practical Survey	... —	100
		1100

Students, who have passed in all subjects of the Final Examination of Overseer Course, subject to Rules 3 and 5 of the Examination Rules, held at the end of the Third Year Class, are granted Certificates by the National Council of Education, Bengal, provided that they have passed in all subjects of the Second Year Class as well.

In order to pass the Final Overseer Course Examination, students who have passed the Final Survey and Draftsmanship Examination, are to appear in the following subjects :—(i) Highway and Irrigation, (ii) Civil Engineering and (iii) Oral test of practical knowledge regarding Overseership. They will be allowed to avail of three chances to pass the Examination.

IV. AGRICULTURE COURSE

(Two Years' Course)

PROGRAMME OF STUDY

First Year Class

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
Ag. Ch. 1	Elementary Agricultural Chemistry	2	4
Agri. 1	Agricultural Botany	2	4
Agri. 2	Farm Crops (Vegetable Gardening)	2	10*
Agri. 4	Animal Husbandry I (first half year)	2	—
Agri. 5	Animal Husbandry II (second half year)		
Agri. 7	Soils and Fertiliser (first half year)	2	—
Agri. 3	Farm Crops II (second half year)		
Shop Works—			6
Ag. W. 1	Carpentry (first half year)		
Ag. W. 1	Smithy (second half year)		
Total		10	24

* First half year.

Second Year Class

SUBJECTS OF INSTRUCTION		PERIODS PER WEEK	
		Theoretical	Practical
Agri. 11	Agricultural Zoology (first half year)	2	—
Agri. 6	Animal Husbandry III (Poultry) (first half year)	2	—
Agri. 10	Horticulture and Floriculture (first half year)	2	4
Agri. 3	Farm Crops II (first half year)	2	10
Agri. 12	Irrigation and Drainage (first half year)	2	—
Agri. 13	Agricultural Economics (first half year)	2	—
Agri. 9	Farm Machinery (first half year)	2	—
	Dairy Practical	—	6
Total		14	20

During second half year students will specialise in one of the following subjects :—(a) Farm Crops, (b) Horticulture and Vegetable Gardening, (c) Dairy Husbandry.

Students, who have completed the above programme of study and have obtained at least 50 per cent marks in the practical Subjects of Instruction, are allowed to appear in the Annual Examinations of the respective classes held at the end of the Academic Session by the National Council of Education, Bengal.

SUBJECTS OF EXAMINATION

Annual Examination at the end of First Year Class

SUBJECT	No. OF PAPERS	FULL MARKS
Chemistry	1	100
Agricultural Botany	1	100
Animal Husbandry	1	100
Agriculture	1	100
Oral and Practical	—	100
		500

Students, who pass in all subjects of the above Examination, subject to Rules 3 and 5 of the Examination Rules, are promoted to the Agriculture Second Year Class.

Students, who fail to pass in not more than two papers in the above Examination, will be promoted to the Second Year Class, but they will have to pass examinations in those papers before they can be granted Certificate by the National Council of Education, Bengal.

Final Examination at the end of Second Year Class

SUBJECT			NO. OF PAPERS	FULL MARKS
Animal Husbandry	...	...	1	100
Agriculture	...	...	1	100
Horticulture & Floriculture	...	...	1	100
Agricultural Engineering	...	...	1	100
Oral and Practical	...	...	—	100
				500

Students, who have passed in all subjects of the Final Examination of Agriculture Course, subject to Rules 3 and 5 of the Examination Rules, held at the end of the Second Year Class, are granted Certificate by the National Council of Education, provided that they have passed in all subjects of the First Year Class as well.

V. AUTOMOBILE ENGINEERING COURSE

TWO YEARS' COURSE

After passing the Annual Examination of this course the students are to undergo practical training in some recognised firm for the remaining year. The Diploma will be awarded to those who can satisfy the authorities of the College with necessary certificates from the aforesaid firms.

FEES & DEPOSITS

At the time of admission to the College, the following fees are payable by new entrants :

	Tuition Fees	Magazine Fees	Contingency Fee	Students' Union Fee	Sporting Fee	Students' Aid Fee	Caution Money Deposit	Total
Automobile Engineering ...	200/-	2/8/-	2/-	1/-	5/-	-/8/-	15/-	226/-

The above fees are payable fully in advance. Caution money deposit for working in the laboratories and workshops and other practical classes is refundable at the end of the College career after deduction for breakage or dues, if any.

EMPLOYMENT

The College does not guarantee to obtain employment for students on completion of the course, but it does guarantee that students will be quite capable of taking charge of any car and of carrying out repairs, adjustments, etc.

The Principal is always willing to answer enquiries which a prospective employer may make regarding any student, feeling confident that those who have taken the course will prove satisfactory.

DETAILED SYLLABUS

1. MOTOR CAR AND ITS MECHANISM :—

Working principles of Petrol engine and cycle of operations, Engine parts as cylinders, valves, pistons, piston rings, Gudgeon pin, Cranks, Bearing etc. Carburettor and its principle of action. Fuel and different methods of feeding. Valves and valve setting cams, Valve gears, Ignition and ignition systems, Spark Plugs, Cooling systems, Pump and Thermo Syphon, Radiators, Lubrication of Engine. Starting, running and maintenance of Engines.

Transmission :—Clutch, various types, Gear Box, Overdrive Gear Box, Propellor Shaft, Universal Joints, Differential, Rear axle, 4-wheel drive, Front wheel drive.

Wheels & Brakes :—Different types of Brakes, Types of wheel rims, Tyres, Inflation.

Chassis :—Steering mechanism, Springs, Different types of suspension.

2. AUTO ELECTRIC APPLIANCES :—

Meaning of volt, Ampere, High and Low tension, Electro-magnets, Condenser, Magneto, Dynamo, Motor, Battery, Electric Lamps and Horns.

3. FITTINGS :—

Filing, Chipping, Use of Callipers, Scales and Micrometer. Use of other general fitters' tools, Drill machine, Dies and Taps, Soldering.

4. MAINTENANCE AND GENERAL REPAIR :—

Decarbonising, Valve grinding, Adjustment of Valves, Changing Piston rings, Adjustment of Bearing, Testing of Spark Plugs, Location and rectification of Engine defects.

5. MAINTENANCE OF AUTO ELECTRIC SYSTEMS :—

Care of Storage Batteries, Charging of Batteries, Electric wiring of cars, Adjustment of Self-Starter, Ignition systems, Testing of Condensers, Magneto, Coil etc.

6. MACHINE SHOP PRACTICE :—

Turning and Screw cutting on lathe, use of various lathe tools, Chucks, Reboring cylinders, Making of new Bearings, Turning of brake drum, Valve and Valve seat grinding, etc.

7. VULCANISING :—

Repair of tubes and tyres.

8. DRAWING :—

Use of Drawing Instruments, Lettering, Division of lines and angles, Construction of plane geometrical figures. Plan, elevation and section of simple solids.

Section of standard screw threads, projection of threads. Standard bolts and nuts. Plan and elevation and end view of simple machine parts, such as, valves, bolts, nuts, screws, tappets, etc. Sketching and preparing drawings from sketches of simple machine parts, such as, piston, connecting rod, cam-shaft, crank-shaft, etc.

9. PHYSICAL TRAINING :—

One hour per week.

PROGRAMME OF STUDY

First Year

SUBJECTS OF INSTRUCTION	PERIODS PER WEEK	
	Theoretical	Practical
Motor Car & its Mechanism	... 3	6
Auto Electrical Appliance	... 3	6
Fittings	... 1	6
Maintenance & General Repair	... —	6*
Maintenance of Auto Electric System	... —	3**
Machine Shop Practice	... —	3*
Vulcanising	... —	6
Drawing	... —	3

Second Year

Practical Training at any recognised firm ... One year

At the end of the session each student shall have to appear in the following papers in the annual examination :—

1. Motor car and Its Mechanism :—	
Paper I one written paper	... 100 marks.
Paper II one oral paper	... 100 marks.
2. Auto Electrical Appliances :—	
Paper I one written paper	... 100 marks.
Paper II one oral paper	... 100 marks.
3. Practical Tests on the mechanical	
Side of a car	... 100 marks.
4. Practical Test on the Electric	
Appliances of a car	... 100 marks.
5. Drawing	... 100 marks.

Minimum Pass Mark is 50%. Students securing 75% or more in the aggregate will be declared to have passed with Distinction. In order to qualify for appearing at the Annual Examination a student must be present at least 80% of all the classes and must secure at least 50% of the marks in the practical classes.

* For two months.

** For one month.

The working days for the course will be the same as in the workshop and only those holidays granted to workshop will be observed as holidays.

Examination Rules :—

1. Only those students who have satisfactorily completed their practical work, satisfied the attendance requirements and paid all dues for the whole session, are eligible to sit for the examination. Examination Fee will be Rs. 17/8/-.

2. A student who has passed the examination in any paper will not have to sit for the examination in that paper again.

3. Only those students who failed to pass in not more than two papers of the Annual Examinations, will be permitted to appear and pass in those papers in two subsequent and consecutive examinations including Supplementary Examination, without attending the classes, provided they can satisfy the Authorities of the College that they are usefully employed in some recognised firm. Intimation of such employment should reach the College on or before the 1st day of September of the year in which they completed their study of the Final Year Class. They will also have to register their names in the College by paying an enrolment fee of Rs. 10/- (Rupees ten) only. Students of this category not engaged in any factory will have to take admission in the College and attend classes and pay all fees for the session.

Students who fail to pass in more than two papers in the Annual Examination will be required to attend the classes and pay regular tuition and other fees. They will have to pass in all remaining papers in the next Supplementary and Annual Examinations.

SYLLABUS

MATHEMATICS

M. 1. Co-ordinate Geometry :

Co-ordinates, Cartesian and Polar. Lengths of straight lines and areas of triangles. Point of division of a straight line. Definition of the Equation to a Locus. Equations of straight lines. Transformation of co-ordinates. Change of axes. Circle, Parabola, Ellipse and Hyperbola—their equations and properties with simple examples. Tangents and normals, Relation between a line and a conic. Tracing some commonly occurring curves whose equations are simple form in Cartesian or Polar co-ordinates. Cartesian co-ordinates in space. Direction-cosines of a line. Length between two points in space. Angle between two lines in space. Point of division of a line in space. Definition of the equation to a locus in space. The plane and the general equation of the first degree in three variables. The straight line in space and its general equations. The projecting planes of a line.

Special Surfaces :—Spheres, cylinders, the projecting cylinder of curve, cones, surfaces of revolution and ruled surfaces.

Tracing of curves will receive considerable attention throughout the whole course.

M. 2A. Differential Calculus :

Constants and variables. Functions. Limits and infinitesimals. Physical meaning of Differentiation. First Principle. Various methods of differentiation Differentiation of constant, sum, product, and quotient of functions, function of a function, inverse function, logarithmic and trigonometrical function. Differentiation of function of several variables. Partial differentiation. Euler's theorem. Differentials. Successive differentiation. Taylor's and

Chem. Eng.
& Eng. 1st
Year ; 4 hrs.
a week ;
Lectures.
1st Semester

Chem. Eng.
& Eng. 1st
Year ; 4 hrs.
a week ;
Lectures.
1st Semester

Maclaurin's theorems. Rates. Maxima and minima. Curvature. Radius and centre of curvature. Convexity and concavity and points of inflexion on a curve. Equations of tangents and normals. Subtangents and subnormals. Study of important technical curves as Cycloid Involute, Epi- and Hypo-cycloid. Calculation of small corrections and percentage errors. Applications of differential calculus from the Engineers' point of view.

M. 2B. Integral Calculus :

Chem. Eng.
& Eng. 1st
Year ; 4 hrs.
a week ;
Lectures.
2nd Semester

Meaning of Integration. Integration of standard elementary forms. Integration by substitution of a new variable ; Integration by parts. Integration by resolution into partial functions. Lengths and areas of plane curves. Volumes of solids of revolution ; simple cases of definite integrals. Mean values. Root mean square values. Successive and partial integration.

M. 3. Integral Calculus and Differential Equations :

Chem. Eng.
& Eng. 2nd
Year ; 4 hrs.
a week ;
Lectures.
1st Semester

Fourier's series. Differential equations of the first order and of the first degree. The operator D. Differential equations of the n th order and the first degree. Simple Geometrical and Physical application chiefly from the Engineer's point of view.

D. M. 1. Algebra and Trigonometry :

D. 1st
Year ; 4 hrs.
a week ;
Lectures.

Algebra—Equations, Simultaneous and Quadratic ; Equational Problems, Graphs ; Simple cases of Surds ; Ratio and Proportion ; Variation ; Elimination, Miscellaneous Exercises ; Binomial theorem, Logarithm, and Use of Logarithmic Tables. Arithmetical and Geometrical Progressions.

Trigonometry—Units and Measures ; Measurements of Angles ; Trigonometrical Ratios ; Relation between Trigonometrical Ratios and easy identities ; Solution of right-angled triangles, and easy problems on heights and distances.

D. M. 2. Practical Mathematics :

Problems on Heights and Distances ; Solution of Triangles ; Field Book ; Area of plane rectilinear figures ; Circles and ellipses ; Length of chord ; Circular arc ; Surface and volumes of solids, *viz.*, prism, cylinder, pyramid, cone, prismoid, and sphere.

Graphs of equations and Trigonometrical ratios.

O. M. 1. Trigonometry and Mensuration :

Trigonometry—Trigonometrical ratios—measurement of angles, Logarithmic series, Cosines etc. Use of logarithmic tables, Solution of triangles. Problems of heights and distances.

Mensuration—Solution of triangles—area of plane figures field-book—surface and volume of solids and frustum of solids—Duodecimals.

PHYSICS

P. 1. Physics :

Heat :—Expansion of gases ; Absolute temperature ; Gas thermometer ; Kinetic theory of gases ; Two specific heats of gases ; Characteristic equations ; Heat as energy ; First Law of thermodynamics ; Gas constant ; continuity of state—Andrew's and Amagat's experiments ; Critical temperature ; Liquefaction of gases ; Relative humidity ; Hygrometers ; Dalton's Law ; Mixture of gases and vapours. Conduction, Convection and Radiation of heat.

Light :—Wave theory of light ; Laws of reflection and refraction by Corpuscular and Wave theories of light ; Wave length of colours ; Refractive index of different colours ; Dispersion ; Spectrum Analysis ; Spherical and Chromatic Aberration, Optical Instruments ; Photometry ; Velocity of light propagation ; Spectrometer ; Polarisation ; Planes of polarisation ; Polarisation by some crystals ; Polarimeter and Saccharimeter.

Sound :—Velocity of sound propagation in different mediums ; Doppler's effect ; Ultrasonic velocity and Super-sonic waves ; Echo depth sounding ; Beat ; Resonance.

P. 2. Physics :

Chem Eng.
& Eng. 1st
Year ; 4 hrs.
a week ;
Lectures.
2nd Semester

Magnetism :—Laws of attraction and repulsion ; Unit pole ; Magnetic Field ; Intensity ; Potential ; Tan A & Tan B positions of Gauss ; Magneto-meter ; Moment of magnets ; Determination of H ; Permeability and Hysteresis of iron ; Magnetic Maps.

Static Electricity :—Electric field ; Intensity ; Potential ; Gauss's theorem and its implications ; Condenser ; Capacity of condensers ; Unit capacity ; Specific Inductive Capacity ; Condensers in series and parallel ; Energy of a charged condenser ; Residual charge ; Electro-meters ; Fundamental Electric Particles.

Dynamic Electricity :—Electric current ; Laplace's Law ; Magnetic field due to current ; C. G. S. unit of current ; Action of currents on magnets ; Action of magnets on currents ; Galvanometers ; Conductors ; Resistance of conductors ; Effect of temperature on resistance ; Resistance of conductors in series and parallel ; Measurement of resistance ; Comparison of E. M. F. ; Wheatstone's bridge ; Potentiometer ; Kirchoff's Law ; Electromagnetic induction ; Faraday's Law ; Lenz's Law ; Eddy current ; Solenoids and electro-magnets ; Magnetomotive force ; Magnetic flux ; Self induction ; Ruhmkorff's Coil ; Transformer ; Thermal effects of current ; Electrical energy ; Conversion of electrical energy into heat ; Electric power ; Incandescent and arc lamps ; Conversion of heat into electrical energy ; Thermopile ; Thermocouple ; Electrolysis and laws of electrolysis ; Electro-chemical equivalent of elements ; Electro-plating.

Elementary treatment of the following : Conduction through gases ; Electrical discharge ; Kathode rays ; X-rays ; Radio-activity ; Electric waves ; Wireless Telegraphy. Photo electricity and Piezo-electricity.

P. 1A. Physical Laboratory :

1. Determination of specific heat of a solid with radiation correction. Ch. E. & Eng. 1st Year ; 4 hrs. a week ; Practical.
2. Determination of latent heat of fusion of ice.
3. Determination of latent heat of vaporisation of water with radiation correction.
4. Determination of co-efficient of linear expansion of a solid.
5. Verification of Boyle's Law.
6. Determination of volume co-efficient of air.
7. Determination of pressure co-efficient of air.
8. Determination of Relative humidity of atmospheric air.
9. Measurement of Thermal conductivity of a metal.
10. Measurement of Refractive Index by microscope.
11. Spectrometer, its adjustment and use.
12. Measurement of indices of refraction by spectrometer.
13. Comparison of moments of bar-magnets, by
 - (a) Tan A method of Gauss.
 - (b) Tan B method of Gauss.
14. Determination of 'H' in the laboratory.
15. Determination of Inclination by Dip-circle.
16. Measurement of resistance of a coil by
 - (a) Wheatstone's Bridge.
 - (b) Post Office box.
17. Determination of resistance of a galvanometer by
 - (a) Thompson's method.
 - (b) Half deflection method.
18. Determination of resistance of a battery by
 - (a) Mance's method.
 - (b) Ammeter and Voltmeter method.
19. Measurement of low resistance.
20. Measurement of Resistance of an electrolyte.
21. Comparison of E. M. F. by Potentiometer.
22. Determination of electro-chemical equivalent of a metal.
23. Determination of Mechanical equivalent of heat.

24. Determination of Reduction factor of a galvanometer.
25. Determination of Temperature co-efficient of resistance.
26. Verification of Fleming's rule.
27. Measurement of Commercial efficiency of lamps.

D. P. 1. Physics :

D. 1st
Year ; 4 hrs.
a week ;
Lectures.

General Physics :—Fundamental units ; Density and Specific gravity ; Fluid Pressure ; Pascal's Law ; Archimedes' Principle ; Compressibility and Expansibility of air ; Air pressure ; Barometer ; Air pump ; Force ; Composition and Resolution of forces ; Gravitation ; Centre of gravity ; States of equilibrium ; Velocity ; Acceleration ; Laws of falling bodies ; Newton's laws of motion ; Work, Energy and Power ; Lever ; Efficiency of simple machines.

Sound :—Nature of Sound, Characteristics of Sound, Velocity of Sound ; Reflection of Sound, Resonance, Nodes, Antinodes, Overtones, Harmonics, Sonometer, Organ pipes, Ear.

Light :—Transmission of light ; Illumination and Photometry ; Reflection and Refraction ; Prisms and Lenses and Simple Optical Instruments ; Nature of light and colour.

Magnetism :—General properties of magnets ; Magnetic Induction ; Magnetic lines of force ; Terrestrial Magnetism and Magnetic Compasses.

Electricity :—Static Electricity, Charge, Potential, Cell, Electric current, E. M. F., Resistance, Ohm's Law.

D. P. 2. Physics :

D. 2nd
Year ; 3 hrs.
a week ;
Lectures.

Heat :—Thermometry ; Expansion and co-efficients of expansion of solids and liquids ; Expansion of gases ; Boyle's Law ; Charles' Law ; Absolute temperature ; Specific heat ; Fusion ; Evaporation and Boiling ; Latent heat ; Calorimetry ; Moist air and Humidity ; Regelation ; Nature of heat ; Mechanical Equivalent of heat ; Radiation ; Conduction ; Convection.

Electricity and Magnetism :—Magnetic Field, Magnetic moment ; Tan A & B position of Gauss ; Capacity ; Condenser ; Atmospheric Electricity ; Magnetic effects of currents ; Electromagnets ; Measurement of currents ; Heating effect ; Chemical effect ; Induction ; Ruhmkroff's coil ; Electric Energy and Power ; Conversion of Electric Energy ; Invisible radiation.

D. P. 3. Physical Laboratory :

1. Use of scales ; Dividers ; Vernier scales ; Sliding calipers, Screw gauge.
2. Determination of volume and height.
- 2a. Use of balance.
3. Determination of centre of gravity.
4. Determination of density of solid by
 - (a) Hydrostatic Balance,
 - (b) Nicholson's Hydrometer,
 - (c) Specific Gravity Bottle.
5. Comparison of density of two liquids.
6. Reading of Barometer.
7. Verification of the laws of Pendulum.
8. Determination of the value of "g".
9. Verification of the laws of Reflection and Refraction of light.
10. Tracing of Magnetic lines of force
 - (a) by iron filings,
 - (b) by magnetic needle.

D. 1st
Year ; 3hrs.
a week ;
Practical.

D. P. 4. Physical Laboratory :

1. Determination of fixed points of a Thermometer.
2. Determination of water equivalent of a calorimeter.
3. Determination of Specific heat of a solid.
4. Determination of Latent heat of fusion of ice.
5. Determination of Latent heat of steam.
6. Co-efficient of linear expansion of a solid.
7. Verification of Boyle's Law.
8. Lines of force of a bar magnet, poles, and neutral point.

D. 2nd
Year ; 2hrs.
a week ;
Practical.

9. Comparison of moments of two magnets.
10. Measurement of dip.
11. Preparation of cells.
12. Setting up of Galvanometer.
13. Measurement of Resistances.
14. Comparison of Electromotive forces.

O. P. 1. Elementary Science :

O. 1st
Year ; 4 hrs.
a week ;
Lectures.

General Measurement :—Fundamental units in C.G.S. and F.P.S. systems. Mass, density and specific gravity. Air pressure, Barometer, Centre of gravity. Boyles law, Syphon, Pressure gauges and Water pumps.

Heat :—Thermometry—Expansion of Solids, liquids and gases—Charles' law, specific heat, Fusion, evaporation and boiling. Latent heat. Radiation—conduction. Heat and Work—Calorific value of coal.

Light :—Transmission of light. Illumination and photometry. Reflection and Refraction, mirrors and lenses.

Magnetism :—General properties of magnets. Magnetic Induction, magnetic lines of force. Terrestrial magnetism.

Electricity :—Statical electricity, charge, potential, cell, electric current, E.M.F., Resistance, Ohm's law.

Physical Laboratory :

O. 1st
Year ; 3 hrs.
a week ;
Practical.

1. Use of Scales, Dividers, Vernier Scale, Screw gauge.
2. Use of Balance.
3. Determination of Centre of gravity.
4. Determination of density of Solids
 - (a) by Hydrostatic balance,
 - (b) by Specific gravity Bottle.
5. Reading of Barometer.
6. Determination of fixed points of thermometer.
7. Determination of specific heat of solid.
8. Verification of laws of reflection and refraction.
9. Photometry.
10. Measurement of Dip.

CHEMISTRY AND CHEMICAL ENGINEERING

Ch. 1. Chemistry of Engineering Materials :

Water for steam generation and industrial purposes ; Fuels and principles of combustion ; lime and gypsum products, sand, cement ; refractory materials ; furnace types ; metallurgical terms and processes ; Extraction of iron and manufacture of various kinds of iron, steel and their alloys ; extraction of Common non-ferrous metals as *Al, Cu, Pb, Sn, Zn*, and their properties, including those of their principal alloys ; properties of *Ag, Au* and *Pt* ; methods of protection of metals, specially iron and steel ; paints and varnishes ; lacquers and enamels ; lubricants ; electrical insulating materials such as glass, porcelain, mica, rubber, plastics, nitro-cellulose products, etc.

Ch. 2. Inorganic Chemistry I :

An introduction to the classification of elements ; Combining weights ; Atomic weights and molecular weights ; Valency ; The periodic system ; The inactive elements ; The halogens ; Oxygen, Sulphur, Selenium and Tellurium ; Air and the nitrogen family of elements, N.P. and As ; Carbon, carbon monoxide ; Carbon dioxide, Coal and coalgas, Combustion and structure of flame ; Silicon, Silica and Silicates ; Boron and Borax ; Hydrogen, Deuterium, Water ; The peroxides and peracids including hydrogen peroxide and ozone ; Introduction to the principles of qualitative analysis and chemical calculations.

Books Recommended :—As in Ch. 4.

Ch. E. 1st
Year ; 3 hrs.
a week ;
Lectures.

Ch. 2A. Qualitative Analysis :

Dry tests for bases and acids. Practice with blow pipe, reduction, borax bead test, flame test and fusion. (This may be omitted here if the student has already acquainted himself fully with the above methods).

Ch. E. 1st
Year ; 9 hrs.
a week ;
Practical.

Insoluble substances, simple methods of solution for insolubles—double decomposition, fusion, extraction with strong acids, etc., etc.

A few preliminary lectures will be given to enable the students to follow the different operations in a systematic analysis for the separation and identification of groups and radicals. The aim should be to impress on the students the necessity of adhering to the required minimum of reagents and chemicals in the manipulation, and to bring home to them the fact that qualitative analysis leads to quantitative if only a balance is used.

The theory of electrolytic dissociation, Osmotic pressure, law of mass action, balanced reactions, solubility product, colloidal solutions.

Individual tests of metals. Division of metals into groups. Systematic analysis of the metals in each group. Reactions in the dry way. Wet reactions. Separation of bases into groups. Detection of acids. Systematic analysis of unknown substances, containing not more than 6 of the following radicals: Ag, Pb, Hg, Cu, Bi, Cd, Sn, As, Sb, Fe, Al, Cr, Zn, Mn, Co, Ni, Ca, Sr, Ba, Mg, Li, K, Na, NH_4 , OH, CrO_4 , AsO_4 , AsO_3 , S_2O_3 , PO_4 , BO_3 , C_2O_4 , CO_3 , Cl, Br, I, F, S, $\text{Fe}(\text{Cy})_6$, CHO_2 , SO_4 , SO_3 , NO_3 , NO_2 , ClO_3 , ClO_4 , OCl , $\text{C}_4\text{H}_4\text{O}_6$ and silicates.

Complete analysis of a few naturally occurring ores and substances.

Ch. 3. Organic Chemistry I:

The growth and the scope of organic chemistry; Purification of organic compounds—solids and liquids. Analysis of organic compounds—qualitative and quantitative. Determination of molecular weights of organic acids and bases by chemical methods. Classification of organic compounds.

Detailed study of Aliphatic or Open-chain compounds:—Saturated Hydrocarbons, unsaturated Hydrocarbons—Olefines and Acetylenes. Halogen derivatives of the paraffins and unsaturated hydrocarbons. Alcohols—Monohydric saturated alcohols and Monohydric unsaturated

Ch. E. 1st
Year; 6 hrs.
a week;
Lectures.
2nd Semester

alcohols. Ethers, Aldehydes and Ketones. Mono-basic Fatty Acids—Saturated acids and unsaturated acids. Acid Chlorides, Anhydrides and Amides. Esters—Esters of organic and inorganic acids. Mercaptans, Sulphonic Acids and Sulphonates, Thio-ethers. Amines. Cyanogen compounds—Cyanogen and Hydro-cyanic acid. Halogen compounds of cyanogen—Cyanic and Cyanuric acids—Thiocyanic acid, Thiocyanates—Nitrites—Carbamines.

Alkyl derivatives of Phosphorus, Arsenic, Silicon, etc. Organometallic compounds—Synthetic uses of Zinc Alkyl compounds and Grignard's Reagents. Polyhydric Alcohols, Carbohydrates.

Hydroxy Monobasic Acids and compounds related to them—Monohydroxy fatty acids—Stereoisomerism of Lactic acids—Amino Acids—Dialdehydes—Diketones—Monobasic Aldehydic and Ketonic Acids—Synthetic uses of Aceto-acetic Ester. Diabasic acids—Carbonic acid derivatives—Saturated and unsaturated Dibasic acids—Monohydroxy and Dihydroxy Diabasic acids—Stereoisomerism of the Tartaric acids and Stereoisomerism of unsaturated acids—Hydroxy poly-basic acids.

Ch. 4. Inorganic Chemistry II:

In continuation of Ch. 2, a detailed study of the metals and their important compounds in the light of the periodic classification of elements, including the alkalimetals, electrolysis and electro-chemical methods; Cu, Ag, and Au; the alkaline earth metals, Be, Mg, Zn, Cd, and Hg; Al, glass and ceramics; Ti, Zr, Ce, and Th; Sn, Pb; Sb, Bi, V; Cr, Mo, W; Se, Te; Mn; Fe, Co, Ni; the platinum metals, the rare earths elements; the radio elements and radio-activity, isotopes and atomic number; the periodic law, polar and non-polar bonds, valency-nuclear, atomic and molecular structure; artificial radio-activity and transmutation of elements. The latter portion may be extended to the 4th year class in order to cover the common topics in the physical chemistry.

Ch. E. 2nd
Year; 4 hrs.
a week;
Lectures.
1st Semester

Detailed descriptions of metallurgical and industrial processes are omitted from this course as they will be more adequately treated in Ch. 11, Ch. 12 and Ch. 15.

Books Recommended :—Text book of Inorganic Chemistry—J. R. Partington ; Inorganic Chemistry—Sherwood Taylor ; Modern Inorganic Chemistry—Mellor.

Ch. 4A. Quantitative Analysis :

Ch. E. 2nd
Year ;
12 hrs.
a week ;
(Half year)
Practical.

Gravimetric Analysis :—Standardisation of a set of Weights ; Determination of water of crystallization in BaCl_2 or CuSO_4 ; Determination of Barium, Sulphur and chlorine ; Estimation of iron as Fe_2O_3 ; Separation of iron from Manganese and from Zinc. Separation of calcium and magnesium in an unknown solution ; Separation of Silica, iron, aluminium, calcium and magnesium in an unknown sample ; Separation of Copper and Nickel electrolytically ; Estimation of nickel by organic reagent Dimethylglyoxime.

Volumetric Analysis :—Standardisation of measuring vessels ; Preparation of standard solutions of acids and alkali ; Estimation of Na_2CO_3 in presence of NaHCO_3 ; Estimation of acetic acid in vinegar ; Standardisation of KMnO_4 solution ; Preparation of standard solution of $\text{K}_2\text{Cr}_2\text{O}_7$; Estimation of Iron in an iron ore ; Estimation of manganese in Pyrolusite ; Preparation of standard thiosulphate solution ; Determination of available Chlorine in bleaching powder ; Estimation of Copper by iodometric methods ; Estimation of Chromium.

Complete Analysis of a few ores and alloys by gravimetric and volumetric methods.

One lecture a week up to December on the methods and principles of quantitative analysis.

Ch. 5. Organic Chemistry II :

Ch. E. 2nd
Year 6 hrs.
a week ;
Lectures.
2nd Semester

Detailed study of the Chemistry of the Cyclic compounds :—(a) Carbocyclic Compounds—Polymethylenes. Aromatic Hydrocarbons including structure of Benzene etc. Aromatic halogen derivatives ; Aromatic Nitro-compounds ; 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. (b) Hetero-cyclic compounds—An elementary study of the Hetero-cyclic Compounds with special reference to Furfurane, Thiophene, Pyrrole, Pyrazole, Pyrazolone, Indole, Carbazole, Pyridine, Quinoline, Isoquinoline and Acridine.

Synthetic Dyes :—Classification of dyes—Important Dye-stuffs of each class with special reference to Azo-dyes and Triphenylmethane Dye-stuffs.

Ureids :—Parabanic Acid, Barbituric Acid, Alloxan, Allantoin, Veronal, Uric Acid, Theophylline, Caffeine, Theobromine, Purine, Xanthine, Guanine.

Terpenes and Camphors :—Monocyclic Terpenes—Terpineol—Limonene—Methone—Menthol. Dicyclic Terpenes—Camphor—Pinene—Borneol. Olefinic Terpenes—Isoprene—Citral—Geranial—Linalool.

Alkaloids :—Classification of Alkaloids. An elementary study of the following Alkaloids : Piperine, Conine, Nicotine, Atropine, Cocaine, Quinine, Cinchonine, Morphine, Strychnine and Brucine.

Synthetic Drugs :—Important compounds of Arsenic. Important members of the following classes of drugs—Antiseptics, Hyponotics and Anaesthetics, Antipyretics, Diuretics and Uric Acid Eliminants. Sulpha drugs and anti-malarial drugs.

Ch. 5A. Organic Preparations and Detections :

(1) *Detection of the following elements in organic compounds* :—Carbon, Hydrogen, Nitrogen, Halogens, and sulphur. (2) *Detection of the following organic compounds* :—Methyl alcohol, Ethyl alcohol, Glycerine, Formic Acid, Acetic Acid, Oxalic Acid, Tartaric Acid, Citric Acid, Lactic Acid, Benzoic Acid, Salicylic Acid, Cane Sugar, Glucose, Starch, Benzene, Aniline, Phenol, Urea, Uric Acid, Formaldehyde, Acetone. (3) *Preparation of*

Ch. E. 2nd.
Year ;
12 hrs.
a week ;
(Half year)
Practical.

the following Organic Compounds:—Methyl Iodide, Methyl Oxalate, Allyl Alcohol, Nitrobenzene, Aniline, Acetanilide, Para nitraniline, Para red, Naphthol Orange, Malachite Green, Sulphonalimide, Malonic ester, D.D.T., Benzoïn, Dibenzyl, Penylhydrazine, Anisole, Picric Acid, Nitro-phthalic acids, Aspirin, Caffeine from tea dust, sodium benzenesulphonate.

Ch. 6. Physical Chemistry I :

Ch. E. 2nd
Year ; 3 hrs.
a week ;
Lectures.

Units and Dimensions—*Gases*:—Postulates of the kinetic theory, the average velocities, mean free path, viscosity, ideal and real gases, Van der Waal's equation, specific heats, concept of the distribution of velocity and energy—Liquid state of matter ; continuity of states, the corresponding state, the critical state, liquefaction of gases, vapour pressure and vapour density, surface tension and surface energy, and viscous properties—Solid state of matter : Types of crystals, isomorphism, Miller index, unit cell, lattice energy and specific heats—Atomic theory and atomic weights—Thermodynamics : First and Second laws, concept of maximum work, reversibility, Carnot's cycle, Kelvin scale of temperature, entropy, thermodynamic potentials, free energy, equilibrium, chemical potential, Gibbs-Helmholtz equation, Gibbs-Duhem equation, Duhem-Margule's equation, Clausius-Clapeyron equation, Joule-Thomson effect and the cooling coefficient—Solutions : Thermal properties, distillation of binary mixtures, azeotropism, Fractional distillation, Dilute solutions and their colligative properties, Osmotic pressure and Van't Hoff's 'i'—Colloids : Their nature, properties, classification and preparation—Thermochemistry : Hess's law and Kirchhoff's equation.

Ch. 7. Physical Chemistry II :

Ch. E. 3rd
Year ; 2 hrs.
a week ;
Lectures.

Chemical Equilibrium : Homogeneous systems, law of mass action, the equilibrium constant, free energy of a chemical reaction, effect of temperature, pressure, etc. on the chemical equilibrium, applications to some technical gas reactions—The Phase Rule : one component systems,

two component systems, binary alloys, three component systems—Chemical Kinetics : Reactions of the first and second orders, activation theory, order of a reaction, catalysis, chain reactions, explosions—Photochemistry : Lambert and Beer's laws, Einstein's law of photochemical equivalence, hydrogen-chlorine reaction—Radio-activity and Subatomic phenomena : Discovery of radio-elements, the disintegration theory, the properties of α and β -rays, Fajan's and Soddy's displacement law, the atomic structure, isotopes, the nucleus and the artificial disintegration—Chemical Thermodynamics : Affinity and its measurement, the Third law of Thermodynamics, the chemical constant, absolute values of entropy and free energy and their application to actual reactions.

Ch. 8. Electrochemistry :

A. *Theory* :—Electrical conductance : the Ionic theory, transport number of ions, the ionic conductance, the complete dissociation theories of Ghosh and Debye and Huckel, applications of conductance measurements—Equilibrium in Electrolytes : Ostwald's dilution law, activity of ions, buffer solutions, avidity, hydrolysis, neutralisation, solubility product, the theory of indicators, modern concepts of acids and bases—electromotive Force : Electrical and chemical energies, concentration cells, liquid-liquid potential, redox potential, redox indicators, the quinhydrone electrode, the pH scale, electrodes used for pH measurement.

Ch. E. 3rd
Year ; 3 hrs.
a week ;
Lectures.

B. *Applications*. Electrolysis and Polarisation : Decomposition potential, Overvoltage, different types of polarisation,—Primary and secondary cells, the standard cell—Electroplating, electro-typing, electro-refining and electro-metallurgy,—Electrolysis of molten electrolytes : Sodium and Aluminium—Electrolysis of aqueous solutions : hypochlorites, chlorates, alkali-chlorine cells,—Electrochemical preparation of permanganates, perchlorates, hydrogen and oxygen and hydrogen peroxide—Electric Furnaces : Arc, Resistance and Induction types—Electro-

chemical Industries : Manufacture of calcium carbide, cyanamides, cyanides, carborundum, graphite, sodium sulphide, carbon bisulphide and phosphorus—Fixation of atmospheric nitrogen—Electrolytic oxidation and reduction.

Ch. 9. Physico-chemical Measurements :

Ch. E. 3rd
Year ;
18 hrs.
a week ;
(Half year)
Practical.

Vapour density determination—Adjustment of thermostats—Determination of density and relative viscosity—Absolute viscosity of a liquid by the flow method—Surface tension by drop method and by capillary rise—Phase diagrams of the phenol-water system and of binary alloys by thermal analysis—Estimations by refractometry and polarimetry—Conductometric experiments on specific conductance, acid-base titrations and solubility of sparingly soluble salts,—Potentiometric measurements of the pH of a buffer solution, titration of a mono-basic strong acid by a strong monacid base and evaluation of the standard potential of a redox system—Colorimetric estimation of pH—Electro-analysis of copper and zinc in a mixture of their salts—Electrochemical preparation of potassium perchlorate and hydrazo-benzol—Purification and distillation of mercury—Transition temperature by the dilatometric method—Rate of hydrolysis of an ester—Heat of neutralisation of a strong acid by a strong base—Experiments based on the Distribution Law.

(The course is covered by 24 experiments.)

Ch. 10. Chemical Engineering I :

Ch. E. 3rd
Year ; 3 hrs.
a week ;
Lectures.

Flow of Fluids ; Transportation of liquids and solids ; Flow of heat ; Combustion, Furnaces and Kilns ; Gas-producers ; Crushing and Grinding ; Principles and methods of mechanical separation. Filtration ; Evaporation and Evaporators.

Books recommended : Principles of Chemical Engineering by Walker, Lewis and McAdams ; Chemical Engineers' Handbook—J. H. Perry ; Heat Transmission—McAdams ; Evaporation, Condensing, and Cooling Apparatus—Hansbrand ; Industrial Filtration—Wright ; Industrial

Furnaces 2 vols—Trinks ; Chemical Engineering Economics—Tyler ; Industrial Chemical Calculation—Howgen and Waston ; Transactions of the Institute of Chemical Engineers—England ; Transactions of the American Institute of Chemical Engineers ; Chem. Plant Design—Vilbrandt.

Ch. 10A. Industrial and Chemical Engineering Calculations I :

Stoichiometry ; Ideal behaviour of gases ; Thermodynamics ; Thermo-chemistry at standard condition ; Thermo-chemistry of Industrial reactions and fuels ; Flow of fluids ; Flow of heat, Weight and Heat balances of Chemical processes ; Chemical equilibrium.

Books recommended : See under Ch. 15A.

Ch. E. 3rd
Year ; 2 hrs.
a week ;
Computation.

Ch. 11. Industrial Chemistry I :

Chemical Industries ; Dry distillation of wood ; Dry distillation of Coal ; Coal tar and its distillation products ; Sulphuric acid ; Nitric acid ; Hydrochloric acid ; Sodium hydroxide ; Bleaching Powder ; Liquid Chlorine ; Sodium Carbonate.

Ch. E. 3rd
Year ; 2 hrs.
a week ;
Lectures.

Ch. 11A. Technical Analysis :

In the Chemical Engineering Second Year Class in the Quantitative Analysis Laboratory from July to end of February—12 periods per week.

1. *Analysis of Iron Steel :* (a) S., (b) Si, (c) P., (d) Mn, (e) Carbon.
2. *Analysis of Water :* (a) Ca., (b) Mg., (c) Fe., (d) Cl, (e) SO_4 , (f) hardness of different types.
3. *Promomate Analysis of Coal :* (a) Moisture, (b) Volatile Matter, (c) Ash content acid, (d) Sulphur.
4. *Analysis of Cement :* (a) Si., (b) Al_2O_3 , (c) Fe_2O_3 , (d) CaO and (e) MgO.

5. *Analysis of Paints* : (with special reference to the analysis of pigments only) (a) White pigment, (b) Green, (c) Yellow, (d) Filler.

In the Organic Chemistry Laboratory

In the Chemical Engineering Second Year Class—March 12 periods per week

In the Chemical Engineering Third Year Class—July to end of November

6. *Analysis of Paints* (contd.)—(with special reference to the Vehicles) (a) Percentage amount (b) Saponification value (c) Iodine value.
7. *Analysis of Fertilisers* : (a) Phosphorus (b) Potassium and (c) Nitrogen.
8. *Analysis of Milk* : (a) Total solid (b) Proteins (c) Fat and (d) Ash.
9. *Analysis of Oil* : (a) Acid value (b) Saponification value (c) Iodine value (d) Hehner value and (e) Unsaponifiable matter.
10. *Analysis of Soap* : (a) Moisture (b) total fatty acid (c) free alkali and (d) Degree of saponification.

In the Physical Chemistry Laboratory

Chemical Engineering Third Year Class—December to end of March—18 periods per week.

11. *Gas Analysis* : (a) By Orsat apparatus.
12. *Thermal Analysis of Alloys* : Simple eutectic systems.
13. *Determination of Viscosity* : with special reference to highly viscous liquids at different temperatures.
14. *Refractometry* : with special reference to estimation of alcohols in spiritous liquids and oils.
15. Determination of Flash points of mineral oils.
16. *Determination of calorific value* : (a) Solid fuels and (b) gaseous fuels.
17. *Saccharimetry* : (a) Estimation of cane sugar in commercial samples.

Ch. 12. Metallurgy :

Metallurgical terms and processes ; Occurrence of metals and their common ores ; concentration of the ores, different methods of concentration, winning of metals from their ores—pyrometallurgical, electro thermal, hydrometallurgical and electrolytic methods ; metallurgical fuels and furnaces ; refractories. Classification of the metals—metallurgy of the ferrous metals, production of iron and its modifications ; the iron carbon system, thermal and mechanical treatment of iron and its alloys ; alloy steel, corrosion of the ferrous metals and its prevention.

Metallurgy of the non-ferrous metals :—copper, lead, tin, zinc, aluminium, magnesium, gold, metallurgy of the less common alloying metals ; the non-ferrous alloys.

Books recommended :

- (1) The Metallurgy of Iron and Steel by Bradley & Strughton
- (2) Metallurgy by Rhead
- (3) Metallurgy of the Common Metals by Austin
- (4) Hand book of Non-ferrous Metallurgy by Liedall
- (5) Engineering Materials by G. C. Banerjee

Ch. 13. Fuels and their Combustion :

Industrial fuels, origin, composition, classification and storage of coal ; prepared solid fuels ; coke-ovens and coke ; chemistry of combustion reaction ; combustion calculations ; combustion of coal on Grates ; operation of hand-fired furnaces, Mechanical stokers and furnaces. Powdered coal as fuel. Liquid fuels and their combustion ; liquid fuels from solid fuels. Gaseous fuels, their production, properties and combustion.

Synthetic fuels. Furnace efficiency and distribution of heat losses. Different types of furnaces, their design and construction.

Books recommended :

- (1) Fuels and their combustion—Haslam & Russel
- (2) Fuel—Brame & King

Ch. E. 3rd
Year ;
2 hrs.
a week ;
Lectures.

Ch. E. 3rd
Year ; 2 hrs.
a week ;
Lectures.

- (3) Industrial furnaces, 2 volumes—Trinks
- (4) Fuels, combustion and furnaces—Griswold
- (5) Chemistry of coal utilization, 2 volumes—Lowry
- (6) Efficient use of fuel—His Majesty's stationery Office, London

Ch. 14. Chemical Engineering II :

Ch. E. 4th
Year ; 4 hrs.
a week ;
Lectures.

(a) Continuation of Ch. 10. Drying ; Driers and Humidifiers ; Distillation ; Diffusional processes for separation of components from a mixture, *e.g.*, Absorption, Adsorption etc. Refrigeration ; Crystallisation ; Temperature measurements ; Chemical Engineering Economics. (b) Cost calculation and preparation of balance-sheets. (c) Materials of construction.

Ch. 14A. Industrial and Chemical Engineering Calculations II :

Ch. E. 4th
Year ; 2 hrs.
a week ;
Computation.

Applications of phase rule to chemical processes ; Vaporization and condensation ; Refrigeration, Air-Conditioning and Drying ; Distillation ; Crystallization ; Mechanical separation ; Filtration ; Extraction ; Crushing and Grinding ; Sedimentation.

Books recommended : (1) Stoichiometry—Lewis and Radasch, (2) Industrial Chemical Calculations—Hougen and Watson, (3) Principles of Thermodynamics—Goodenough, (4) Thermodynamics for Chemical Engineers—Weber, (5) Text-books of Chemical Engineering as mentioned under Ch. 10.

Ch. 15. Industrial Chemistry II :

Ch. E. 4th
Year ; 2 hrs.
a week ;
Lectures.

Technological Industries : Pulp, paper, Nitro-cellulose, Artificial Silk ; Starch, Glucose, Dextrin ; Cane Sugar, Gurh, Molasses ; Alcohol ; Tanning ; Glue and Gelatine ; Plastics ; Matches ; Fertilisers ; Glass, Enamel, Pottery ; Lime, Cement Plaster.

Books recommended : Industrial Chemistry by Rogers and Aubert ; Industrial Chemistry by Martin ; Industrial

Chemistry by Thorp ; Principles of Applied Electrochemistry by Allmond ; Industrial Chemistry by Riegel ; Synthetic Resins by Ellis ; Vegetable Casein.

Ch. 16. Chemical Engineering Laboratory and Plant Operations :

1. Measurement of flow of fluids through orificemeters, Venturimeters, Rotameters, Weirs etc. and calibration of different flowmeters.
2. Flow of fluids through bends, loops etc. and estimation of friction losses ; efficiency of pump.
3. Measurement of approximate critical velocity of a liquid.
4. Gage testing with deadweight testers and calibration.
5. Determination of efficiency of a gas-fired boiler furnace.
6. Rate of filtration under different pressures in a monel metal plate & frame type filter press and a leaf press, and estimation of compressibility, coefficient of plugging etc.
7. Running of continuous rotary filter, basket centrifuge and super centrifuge.
8. Drying rate under constant drying conditions and atmospheric pressure.
9. Drying rate under constant drying conditions in vacuum.
10. Running of a vacuum double drum drier.
11. Concentration of minerals by froth flotation and taking test date.
12. Mechanical separation by Wilfley table.
13. Running of a Dorr thickener.
14. Dry classification by pneumatic classifier.
15. Wet classification by Hydraulic and Dorr bowl classifier.

Ch. E. 4th
Year ; 14 hrs.
a week ;
Practical.

16. Running of a continuous countercurrent decantation plant and taking test data.
17. Crushing and grinding of substances of different hardness by Jaw Crusher ; Disc crusher ; Rotary crusher ; Crushing rolls ; Hammer mill ; Pot mill and Ball mill and relation of energy consumption and Screen analysis of different products ; estimation of Rittinger's and Kick's constants, and comparison of grindability.
18. Dry and wet grinding in continuous ball mill, estimation of critical R.P.M. and effect of speed on product, size and capacity.
19. Electro-plating.
20. Complete run of the following plants and taking test data :—
 - (a) Oil extraction plant ;
 - (b) Water distillation plant.

Also the following experiment in the Mechanical Engineering Laboratory :—

1. Testing for tensile strength ;
2. Use of Junker's calorimeter ;
3. Use of Planimeter ;
4. Running & Maintenance of Diesel engine ;
5. Running & Maintenance of steam engine ;
6. Running & Maintenance of Centrifugal pump ;
7. Running & Maintenance of Loco-boilers ;
8. Running & Maintenance of steam turbine ;
9. Use of Brinell hardness testing machine ;
10. Calibration of pressure gage ;
11. Calibration of Vacuum gage.

Books recommended for Chemical Engineering Laboratory Works : (i) Chemical Engineering Laboratory equipment—Zimmerman & Levine ;
(ii) Applications of Chemical Engineering—Harry McCormack.

Ch. 17. Chemical Technology of Oils and Fats : (Theoretical)

Chemical Nature of Fats and Oils—structure, composition, properties and Reactions of Fats and Fatty Acids. Classification of Oils and Fats.

Raw materials for Oil and Fat products—sources, classification, production, consumption and storage of Oil and Fat bearing materials.

Unit process in Oil and Fat Technology—Extraction of Fats and Oils ; Refining and Bleaching ; Deodourization ; Hydrogenation ; Fat splitting ; Soap Making ; Fractionation of Fats and Fatty Acids ; Esterification and Interesterification ; Emulsification and Homogenization.

Utilization of Fats and Oils—Edible products such as cooking and salad oils, Margarine and Butter, Vegetable Ghee, Bakery products and confections etc., Non-edible products such as Plastic shortening Agents, Paints and Varnishes, Printing Ink ; Oil cloth ; Insulating Fabrics, Waterproofing Linoleum ; Soap—Toilet, Washing and Industrial.

Ch. E. 4th
Year ; 3 hrs.
a week ;
Lectures ;
(Elective).

Ch. 17A. Chemical Technology of Oils and Fats: (Practical).

Detection of adulterants in common oils and Fats., Tallow, Coconut oil, Groundnut oil, Castor oil, Sesame oil, Mohua oil, Linseed oil, Mustard oil, etc.

Identification of Fats and oils ; advanced course of oil and Fat Analysis ; Rendering of Tallow and Fish oils.

Refining and Bleaching of oils ; Deodourization ; Estimation of colour ; FFA and Vitamins of crude and Refined oils and Fats.

Fat splitting ; separation of solid and liquid acids ; Testing of Acids and Glycerine.

Preparation of soap by cold process ; Analysis of soap and Glycerine.

Preparation of hardened Fat and Testing. Polymerization of Oils. Testing of Drying properties of polymerised Oils.

Ch. E. 4th
Year ; 6 hrs.
a week ;
Practical ;
(Elective).

Ch. 18. Glass and Ceramic Technology :

Ch. E. 4th
Year ; 3 hrs.
a week ;
Lectures
(Elective).

General study of different types of refractory materials and their classification and properties with special reference to Indian fireclays. Treatment and testing of fireclays.

Manufacture, properties and uses of :—

- (a) Fire bricks and fireclay products such as crucibles, glass house pots, furnace blocks and muffles.
- (b) Silica and sillimanite refractories.
- (c) Bauxite bricks.
- (d) Insulation bricks.
- (e) Refractory mortars and cements.

Specifications and tests for refractories with special regard to suitability for the glass industry.

Brief history of the glass industry.

Definition of glass and characteristics of the vitreous state.

Common glass forming oxides and raw materials.

General formulae for glass compositions and simple batches—

Calculation of glass composition from batches and vice versa.

Processes of melting and refining.

Outlines of glass manufacturing processes : hand methods of production.

A general treatment of glass melting furnaces, annealing kilns and lehrs, pot arches and glory holes.

Important properties of glasses as related to chemical composition.

- (a) Mechanical properties : Sp. gravity, elasticity and strength.
- (b) Thermal properties : Expansion, sp. heat and conductivity.
- (c) Viscosity : Adaptability of chemical composition to manufacturing processes.
- (d) Thermal Endurance.
- (e) Chemical durability.

(f) Optical properties : refractive index, dispersion and absorption.

Decolorising of glass.

Annealing of glass.

Batches and compositions for various types of glasses, such as bottles, tableware, sheet glass, chemical ware etc.

Classification of glassware.

Outlines of important manufacturing processes : Mechanical and automatic methods for bottles, pressed ware, sheet and plate, tubing etc.

Decorative processes : enamelling, etching, frosting etc.

Devitrification and common defects in glassware.

Books recommended :

1. Textbook of glass technology—Hodkin & Cousen
2. Modern Glass Practice—S. R. Scholes
3. Defects in glass—C. J. Peddle
4. Glass : The Miracle Maker—C. J. Phillips
5. Properties of Glass—G. W. Morey
6. Manufacture, Properties and Uses of Refractory Materials—A. B. Searle
7. Refractories—Norton

Ch. 19. Food Technology :

Nutrition :—

A study of factors necessary for proper nutrition including carbohydrates, fats, proteins, vitamins, inorganic substances, water etc., Enzymes, the Chemistry and the mechanism of the action of enzymes and the importance and their action in living tissues with special reference to the problems in food industries.

Introduction to Bacteriology :—Classification and morphology of bacteria ; physiological activities of bacteria ; growth oxidation, carbohydrate disimilation, protein and amino acid requirements and variations study of the activators and inhibitors of the growth processes of micro organisms.

Ch. E. 4th
Year ; 3 Lec-
tures per
week
(Elective).

General principles of canning, refrigeration dehydration and other methods of food preservation, Technology of fish and fish products, milk and milk products, meat and poultry, fruit and fruit products, vegetables, cereals, beans, nuts and candies, soft drinks.

Packing and transport of foods :—

Food plant sanitation :—

Food engineering :—design and construction of equipments used in the preparation and handling of food stuffs, including canning machinery, packaging machines, bottling equipment, conveying systems, bakery installation etc.

Industrial microbiology :—Study of industrial production of ethyl alcohol, acetic acid, citric acid, lactic acid, etc. by microbiological methods. Manufacture of pickles & cheese.

Ch. 19A. Food Technology Laboratory :

Ch. E. 4th
Year ;
6 periods
per week,
(Elective).

Bacteriology : preparation of culture media ; isolation and identification of organisms ; staining ; counting of micro-organisms, determination of thermal death point of bacteria, determination of phenol-coefficient for different disinfectants, examination of water, milk and other food-stuffs.

Enzymology : preparation of enzymes and study of their activities, qualitative and quantitative estimation of phosphatase, peroxidase, catalase in food products.

Food and nutrition chemistry : assay of protein, fat, carbohydrate and vitamins and different minerals in food stuffs.

Food precessing : Experiments to illustrate the problems in canning, dehydration and freezing of food and the control techniques ; pasteurization of milk and fruit juices ; preparation of fruit jelly, malt, etc.

Soap Technology :

A special course of 15 to 20 lectures is arranged every year.

For the laboratory courses Ch. 2A, Ch. 4A, Ch. 5A and Ch. 9. 30 per cent of the total marks will be allotted

to a written examination to be held immediately at the end of the laboratory course by the teachers in charge of the course.

D. Ch. 1. Chemistry :

Fundamental units ; Ordinary laboratory processes for purification of substances ; Pure substances ; Elements and compounds ; Symbols, Formulae ; Terminology and Nomenclature ; Three states of matter ; Gas laws ; The Study of air and water ; Oxygen and combustion ; Hydrogen and water ; Solutions ; Nitrogen and Atmosphere ; Oxides of Nitrogen and Nitric acid ; Atoms and molecules ; Chlorine ; Hydrochloric acid ; Ammonia ; Acids, Bases and Salts ; Simple idea of laws of Chemical Combinations ; Chemical equations.

D. 1st Year ;
2 hrs. a
week ;
Lecture.

D. Ch. 1A. Chemical Laboratory :

Simple laboratory methods of purification of substances, e.g., filtration, evaporation, distillation, sublimation and crystallisation ; fitting up of a wash bottle, simple methods of glass blowing.

D. 1st
Year ; 2 hrs.
a week ;
Practical.

Preparation and study of the properties of the following gases :—Hydrogen, Oxygen, Chlorine, Ammonia and Carbon dioxide.

Determination of the solubility and yield of a crystalline substance like copper sulphate or potassium nitrate.

D. Ch. 2. Chemistry :

Carbon and its allotropic forms ; Oxides of Carbon ; Methane ; Ethylene ; Acetylene ; Coal Gas ; Sulphur and its allotropic modifications ; Hydrogen sulphide ; Oxides of sulphur ; Sulphurous and sulphuric acids ; Phosphorus ; Metals and nonmetals ; Elementary study of the following metals and their salts of common acids—Sodium, Potassium, Calcium, Magnesium, Iron, Copper, Zinc, lead.

D. 2nd
Year ; 2 hrs.
a week ;
Lecture.

Ag. Ch. 1. Elementary Agricultural Chemistry :

Agri. 1st
Year ; 2 hrs.
a week ;
Lecture
& 4 hrs.
a week ;
Practical.

Elements, compounds & mixtures. Separation of the components of a mixture of solids. Decantation. Filtration. Solution. Evaporation. Distillation. Precipitation. Ignition. Crystallisation. Sublimation. Efflorescence. Delequescence.

Chemical symbols, formulae, Valency and equations. Acids. Bases. Salts : their distinctive properties. Acidity and alkalinity ; their quantitative estimation. Water ; its constitution ; pure and natural water. General knowledge of elementary chemistry. Oxygen, Hydrogen, Carbon, Nitrogen, Phosphorus, and Sulphur and their compounds.

Ammonium salts.

Air.

ELECTRICAL ENGINEERING**E. E. 1. Principles of Electrical Engineering I :**

A detailed study of the Units and laws of Electric and Magnetic Circuits ; Chemical effect of Current ; Principles of Storage Batteries ; D. C. Circuits and Networks ; Elements of measuring Instruments ; Vector Algebra ; the Elementary Alternator ; Effective Current and Voltage ; Complex Quantities used in Electrical Engineering ; Circuits containing Resistance Inductance and Capacity ; Series, Parallel and Series-parallel Circuits ; Power-factor,

E. E. &
M. E. 2nd
Year ; 3 hrs.
a week ;
Lecture.

E. E. 2. Electric Wiring and Installations :

Conductors ; Insulators ; Installation Materials ; Industrial Lighting and Domestic Wiring installations ; Lighting and Illumination ; Domestic Loads ; Determination of size of Conductor ; Voltage Drop ; Heating ; Switching and fusing ; I.E.E. and Indian Electricity Rules ; Design and Estimating of a Domestic Installation.

E. E. &
M. E. 2nd
Year ; 2 hrs.
a week ;
Lecture.
1st Semester

E. E. 3. Direct Current Machines :

Principles of Generation of Direct Current. E.M.F. ; Armature Windings ; Magnetisation Curve ; Armature Reaction ; Operating Characteristics of D. C. Generators ; Compensation of Armature Reaction ; Commutation ; D. C. Motors ; Efficiency ; Rating and Heating ; Generators for special purposes ; Parallel Operation of Generators.

E. E. &
M. E. 2nd
Year ; 4 hrs.
a week ;
Lecture.
1st Semester

E. E. 4. Principles of Electrical Engineering II :

Balanced and Unbalanced Polyphase Circuits ; Measurement of Power in Polyphase Circuits ; Mutual Induction ; Non-Sinusoidal Waves ; Harmonic Analysis ; Growth and Decay of Current in D.C. and A.C. Circuits ; Magnetic Circuit and Inductance of Cables and Overhead Lines ;

E. E. 3rd
Year ; 3 hrs.
a week ;
Lecture.

Dielectric Circuit and Capacitance of Cables and Overhead Lines ; Symmetrical Components.

E. E. 5. Differential Equations and Operational Calculus :

E. E. 3rd
Year ; 2 hrs.
a week ;
Lectures.

Differential equations of the second order and of the second degree. Homogeneous equations with constant Coefficients. Heavysides' Operator, Direct Operational Methods, Series expansion of operators, Special circuit problems and artifices, Solution of networks with constant parameters or problems of a sudden short-circuit, a sudden discharge of a line, lightning surges, transients etc. study of Hyperbolic functions.

E. E. 6. Alternating Current Machines I :

E. E. 3rd
Year ; 4 hrs.
a week ;
Lectures.

Alternators ; Transformers ; Induction Motors ; Synchronous Motors ; Parallel Operation of Alternators.

E. E. 7. Alternating Current Machines II :

E. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

Single-phase Induction, Series and Repulsion Motors ; Rotary Convertors ; Motor Convertors ; Frequency Convertors ; Phase Advancers ; Mercury Arc Rectifiers.

E. E. 8. Electrical Measuring Instruments and Measurements :

E. E. 3rd
Year ; 3 hrs.
a week ;
Lecture.

Ballistic Galvanometer ; Flux meter ; Photo-electric instruments ; A.C. Watt meters ; Indicating instruments ; Single-phase & Poly-phase Energy meters ; Sine meter ; Demand meter ; Instrument Transformers ; Frequency meter ; Power-factor meter ; Phase Rotation Indicator ; Synchroscope ; Recording instruments ; Study of Methods of Control ; Damping ; Response, Bearing etc.

Principles of Selection of Instruments ; Standardising Laboratory Technique ; Calibration of Instrument Transformers ; Technique of Meter Testing ; Verification of Poly-phase meter connections ; Load Totalising & Telemetering ; D.C. & A.C. Bridges ; Principles and Applications of D.C. & A.C. High Voltage Testing ; The Sphere

Gap ; Electrostatic Voltmeter ; Surge Testing ; Clydonograph ; Kathode-Ray Oscillograph ; Magnetic Measurements ; Photometric Measurements.

E. E. 9. Electric Power Distribution :

D. C. Distribution Systems ; Boosters and Balancers ; Low-Tension and Medium-Tension A. C. Distribution Systems ; Line Insulators ; Poles and Masts ; Approximate Sag-tension Calculations ; A.C. Distribution Voltage Regulators ; High Voltage A.C. Distribution over short Transmission Lines ; Approximate Method of Solution ; Distribution System Design Economics ; Indian Electricity Rules and other Regulations. Sub-Stations.

E. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

E. E. 10. Electric Power Transmission :

Hyperbolic Functions ; Long Transmission Line with uniformly distributed Resistance, Inductance and Capacitance ; Transmission Line Conductors ; High Voltage Line Insulators ; Extra High Voltage Cables ; Mechanical Design of Transmission Lines ; Economics of Span Design ; Corona Effect ; Inductive Interference ; Line Performance diagrams ; Power Limits and Stability ; Travelling Waves ; Transmission Line Protection.

E. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

E. E. 11. Electric Generating Station :

General layout of Dissel, Steam and Hydraulic Power Plants. Location of Generating Units and Auxiliaries, Switchgear, Transformers and Control. Principles of paralleling Alternators, Generating Stations and Sub-Stations. Voltage and Frequency Control of Alternators, and Stations and Sub-Stations. Base-load and peak-load units. Scheduling and transferring loads amongst alternators in a station, amongst generating stations in a grid system.

Calculation of short-circuit currents. Methods of limiting short-circuit currents by reactors. Determination of circuit-breaker capacity. Choice of circuit-breakers and relays for protection of generators and transformers. Layout of bus-bars and switchgear.

E. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

Generating Stations Logs ; Load Curves—Chronological load curve, load duration curve and energy load curve ; Load Topographs. Station Factors—Load Factor, Capacity Factor, Utilization Factor, Demand Factor, Peak Diversity Factor. Cost of power generated.

Principles of Rate-making for different kinds of consumers.

Principal Tariffs—Flat Rate Tariff (Two-rate, Multi-rate), Block Rate (Sliding Scale) Tariff, Maximum Demand Tariff, All-in-Tariff etc. Rate Adjustments.

E. E. 12. Power Utilisation and Traction :

E. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

Characteristic Curves of Motors. Mechanical features of motors. Types of drives. Winding Insulation of Motors. Bearings.

Kinds of service—Constant duty, varying load duty, pulsating load, impulse load, short-time load and intermittent duty. Methods of determining power requirements.

Suitability of different kinds of motors for different services. Principal limitations of motor rating.

Electric Railways, Tramways and Trolley Buses. Systems of Power supply. Speed-time Curves, Acceleration, Train Resistance, Energy Consumption. Characteristics of Traction Motors. Regenerative and other Braking.

E. E. 16. A. C. Machines and Power Distribution:

M. E. 3rd
Year ; 3 hrs.
a week ;
Lecture.

Elementary Principles of Alternating Current ; Poly-phase Circuits ; Construction, Operation and Simple Characteristics of Alternators ; Transformer, Induction Motors, Synchronous Motors, Rotary Convertors and other important machines ; A. C. Instruments ; Elements of Electric Power Distribution including use of Switch Gears, Insulators and Protective Devices.

E. E. 17. Electrical Engineering :

Ch. E. 2nd
Year ; 3 hrs.
a week ;
Lectures.

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 Alternating Currents ; Circuit 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 ; Switchboard 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.

E. E. 17A. Electrical Engineering Laboratory :

1. Measurement of Resistance ; 2. Measurement of Internal Resistance of Storage Battery ; 3. Calibration of Ammeter and Volt-meter ; 4. Study of Energy-meters ; 5. Study of D. C. Generators (Shunt, Series and Compound) ; 6. Characteristics of an A. C. Series Circuit ; 7. Study of Alternators (Single and Poly-phase) ; 8. Measurement of three-phase Power by two Wattmeters ; 9. Synchronising and Parallel operation of two Alternators ; 10. Study of a Poly-phase Induction Motor ; 11. Study of a Transformer ; 12. Study of a Rotary Converter ; 13. Study of an Induction Regulator.

Ch. E. 2nd
Year ; 3 hrs.
a week ;
Practical.
2nd Semester.

E. E. 18. Electrical Drawing :

Standard Symbols, Armature Winding Diagrams ; Outline Drawings of Generators, Motors, Switches etc. ; Sectional Drawing of D. C. Generator or Motor and D. C.

E. E. 4th
Year ; 3 hrs.
a week ;
Practical.

Circuit Breaker ; Standard Circuits ; Curve Tracing ;
Nomography ; Problems in D. C. Machines and Circuits.

E. E. 19. Electrical Design and Drawing :

E. E. 3rd
Year ; 3 hrs.
a week ;
Practical.

Design and estimating of a Factory Lighting and Power
Wiring System ; Sectional Drawing of Different Types of
Conductors and Cables ; Design of Electromagnets, Regu-
lators and Heaters.

E. E. 20. Electrical Project and Design :

E. E. 4th
Year ; 6 hrs.
a week ;
Practical.

Design of an Electrical Project ; Design of D. C.
Machine ; Alternator, Transformer, Induction Motor and
Convertor.

E. E. 21. Electrical Engineering Calculations :

E. E. 3rd
Year ; 2 hrs.
a week ;
Computa-
tion.

Calculations covering subjects E. E. 4, E. E. 6 and
E. E. 8.

E. E. 22. Electrical Engineering Laboratory I :

E. E. &
M. E. 2nd
Year ; 3 hrs.
a week ;
Practical.

1. To measure resistance by ammeter and volt-meter method.
2. Calibration of voltmeter and ammeter by comparison.
3. Study of a Direct Current Generator.
4. Calibration of a D. C. Ampere-hour meter.
5. Measurement of Permeability.
6. Magnetization Curve of a D. C. Generator.
7. Characteristic Curves of Shunt and Compound Generators.
8. Characteristic Curves of Series Generator.
9. Determination of Losses and Efficiency of D. C. Generator.
10. Performance Curves of a Series Motor.
11. Performance Curves of Shunt and Compound Motors.

12. Parallel Operation of Generators.

13. Characteristics of A. C. Series Circuit.

14. Characteristics of A. C. Parallel Circuit.

15. Operation tests in Storage Battery.

16. Localisation of Faults in Electric Mains by Murray's Loop Method.

E. E. 23. Electrical Engineering Laboratory II :

1. Separation of losses in a D. C. Generator.

E. E. 3rd
Year ; 3 hrs.
a week ;
Practical.

2. Efficiency Test on a Shunt Motor by Hopkinson Method.

3. Study of Rosenberg type of Train Lighting Generator and System.

M. E. 3rd
Year ; 3 hrs.
a week ;
Practical
(Half-year)
Expt. No.
1, 4, 5, 6,
7, 11 & 16.

4. Magnetization Curve of an Alternator and Determination of its Regulation by Synchronous-impedance Method.

5. Measurement of Power and Power-factor of a 3-phase system by two watt-meters.

6. Measurement of Slip of an Induction Motor by Sector-disk Method.

7. Regulation and Efficiency of a Transformer from losses.

8. Performance Curve of an Alternator.

9. Effect of variation of Excitation of a Synchronous motor at constant load.

10. Performance Curves of Induction Motors.

11. Characteristic Curves of a Synchronous Convertor and Inverted Rotary.

12. Performance and Vector Diagram of an Induction Regulator.

13. Heat Run on a Transformer.

14. Balancer on a 3-wire System with two Shunt Machines.

15. Separation of Iron Losses of a Transformer.

16. Synchronising of Alternators.

E. E. 24. Electrical Engineering Laboratory III :

E. E. 4th
Year ; 6 hrs.
a week ;
Practical.

1. Transformer Connections and Determination of Ratio of Transformation.
2. Dielectric Strength of Insulating Oil.
3. Circle Diagram of Induction Motor.
4. Calibration of A. C. three-phase watt-hour meter.
5. Commercial Test on three-phase Alternator.
6. Efficiency and other Tests on Storage Battery.
7. Photometric Test on Incandescent Lamps.
8. Performance Test on Induction Generator and Motor.
9. Test on three-phase Pole-changing Induction Motor.
10. Standardisation of Ammeters and Voltmeters.
11. Test on Repulsion Motor.
12. Test on Rosenberg Generator.
13. Testing of Rectifier Valve with Oscillographic Record of Current.
14. Characteristics of Thermionic Valves and Determination of its Constants.
15. Measurement of Capacity and Inductance.
16. Setting up of High Frequency Oscillator.
17. Setting up of a Receiving Circuit.
18. Experimental study of characteristic of detectors and vacuum tube Voltmeter.
19. Determination of value of constants by dynamic method.
20. Study of Magneto and Common Battery Telephone system.
21. Measurement of High Voltage by Sphere-gap.
22. High-voltage Tests on Line Insulators.
23. Testing of Insulation by High-voltage Direct Current.
24. Tests on Mercury Arc Rectifier.

E. E. 25. Electrical Workshop :

1. Overhauling of Electric Machines.
2. Locating Faults in Electric Mains.
3. Insulation Resistance of Electric Machines and Installations and Calculation of Leakage Current.
4. Measurement of Resistance of Earth Plate.
5. Winding of Armature, Field, etc.
6. Jointing of Overhead Electric Lines.
7. Underground Cable Joints.

E. E. 4th
Year ; 3 hrs.
a week ;
Practical.

E. E. 26. Abstract :

In this course each student will be required to write an article of about 2000 words on a current engineering topic assigned by the teacher and to give concise talk on the subject for 10 minutes in the class, by rotation. The result of these assignments will be considered as that of practical work. There will be no written examination for this course.

E. E. 4th
Year ; 2 hrs.
a week ;
Recitation.

D. E. E. 1. Electrical Engineering :

Properties of materials used in electrical work ; Electric units ; General Laws ; Specific resistance and calculation of resistance ; Effect of heat on electrical resistance ; Electrical properties of materials ; Equivalent resistance of electrical circuits in series and, or parallel.

Magnetic, thermal and chemical effects of current ; Current ; Potential and fall of potential in electric circuits ; Calculation of size of cable for different electrical circuits ; Power and energy ; Relation between electrical and mechanical units of power.

Magnetic properties of materials ; Electro-magnets and rules for finding polarity ; Lines of force of a magnet ; Magnetic pull on a current carrying conductor ; Magnetic circuits ; Magnetising force ; Flux, flux density and permeability ; Hysteresis effect.

Condenser ; Capacity and Energy.

D. 2nd
Year ; 2 hrs.
a week ;
Lecture.

D. E. E. 2. Electrical Engineering I :

D. 3rd
Year ; 2 hrs.
a week ;
Lecture.

Direct Current Electrical Engineering—Measuring Instruments ; Measurement of resistance, Current, Voltage, power and energy ; Ammeter, Voltmeter, Wattmeter and energy-meter.

Storage Batteries :—Chief types ; installation ; capacity and efficiency ; Charging and discharging ; Connection, operation, care and maintenance.

Direct current machines :—Different types of generators and motors ; Armature windings ; Operating characteristics ; Efficiency and losses ; parallel running of generators ; Speed control of motors ; Boosters and balancers ; Installation ; Operation ; Repair ; Care and maintenance.

D. E. E. 3. Electrical Engineering II :

D. 3rd
Year ; 2 hrs.
a week ;
Lecture.

Alternating Current Electrical Engineering—Principles of Alternating Current ; Sine waves of voltage and current ; Effective and average values ; Circuits containing resistance, inductance and capacitance ; Calculation of conductance, susceptance, admittance and impedance ; Resonance ; impedances in series, parallel and mixed circuits ; Frequency, power factor and measurement.

Alternating current machines ; Synchronous generators and motors ; Transformers ; Rotary converter ; Single and poly phase induction motors ; Synchronising and parallel operation of generators ; Installation, operation, repair, care and maintenance.

D. E. E. 4. Electrical Engineering Laboratory :

D. 3rd
Year ; 3 hrs.
a week ;
Practical.

To study different parts of a dynamo.

To study M.I. and M.C. types of voltmeters and ammeters.

Measurement of resistance by voltmeter and ammeter.

To find resistance of armature and field coils.

Cable joints and soldering.

Insulation resistance of a plant while working by a voltmeter of known resistance.

Calibration of voltmeter, ammeter and house-meter.

No load characteristic of a D.C. generator.

External characteristic of a shunt generator.

Armature winding.

To sketch out switch-board connections.

Variation of speed of a shunt motor.

To run a compound motor and to reverse the direction of rotation.

To run a series motor with drum type controller.

To study the use of a meggar.

To test and locate faults in armature, field coils and commutator.

Wiring, calculation of size of cable and cost.

To charge storage battery and measurement of internal resistance.

Study of A.C. series and parallel circuits.

Three-phase connection in delta and star.

Synchronising 3-phase alternators.

To run induction motor and to reverse direction of rotation.

To connect transformers in delta, star and open delta.

Measurement of 3-phase power by two wattmeters.

O. E. E. 1. Elementary Electrical Engineering :

Lightning conductor—parts used in and general rules for erection ; function of the lightning conductor, earth resistance and method of measuring it. Tests.

House Wiring—Layout of simple D.C. distribution systems—working of simple switch boards. Protection devices and fault in a small power station.

O. 3rd
Year ; 3 hrs.
a week ;
Lecture.

DRAWING

D. 1. Drawing :

Construction of Scales ; Construction of Curves ; Orthographic and Isometric Projections ; Sections in Orthographic projections ; Conventions in Mechanical Drawing ; Dimensioning ; Working ; Drawing of simple machine parts

Ch. E. &
Eng. 1st
Year ; 6 hrs.
a week ;
Practical.

such as bolts, nuts studs, rivetted joints, keys, fly-wheel, pulleys, coupling brackets; Tracing and Blue-printing.

D. 2. Descriptive Geometry :

E. E. & M. E. 1st Year; 3 hrs. a week; Practical. Four angles of Projection in Orthographic projection; Problems on Points, Lines, Planes, and Solids; Sections and Developments; Tangent lines and planes, Warped surfaces; Interpenetration.

D. D. 1. Drawing :

D. 1st Year; 9 hrs. a week; Practical. Use of Drawing instruments; Lettering; Division of lines and angles; Construction of plane geometrical figures; Area and similar figures; Scales (plane and diagonal); Construction of Ellipse, Parabola, Hyperbola, Cycloid and Involute.

Plan, elevation and section of simple solids; singly or in combination; Sections of standard screw threads, projection of threads; Standard bolts and nuts.

D. D. 2. Drawing :

D. 2nd Year; 6 hrs. a week; Practical. Isometric scales and isometric projection of joints used in carpentry work; Plan, elevation and end view of simple machine parts, such as rivetted joints, screws, bolts, nuts, keys, shaft, shaft-coupling, pulleys, bearings, etc.

Sketching and preparing drawings from sketches of simple machines such as Polishing Lathe, Press-machine, Screw Jacks, etc.

D. D. 3. Drawing :

D. 3rd Year; 9 hrs. a week; Practical. Working drawing of machine parts; Engine details; Tracing; Blue-printing; Machine sketching; Making of assembly and working drawings from sketches; Reading and checking of drawings.

ENGINEERING MECHANICS

E. M. 1. Engineering Mechanics I :

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, Momentum, Units of force; Motion of connected bodies, Attwood's Machine.

Work, graphical representation of Work; Power, Energy, Principle of Work; Conservation of energy.

Circular motion, Centrifugal and centripetal force, 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.

E. M. 2. Engineering Mechanics II :

Centre of parallel forces; Centre of mass; Centre of gravity; Different states of equilibrium; Theorem of Guldinus or Pappus; Moment of Inertia: Radius of Gyration; Changes of energy and speed; Laws of rotation of a rigid body; Kinetic energy of rotation; Compound pendulum; Torsional and compound harmonic motion; Kinetic energy of rolling bodies.

Ch. E. & Engg. 1st Year; 4 hrs. a week; Lecture.

E. E. & M. E. 2nd Year; 3 hrs. a week; Lecture.

Graphical statics ; Bow's notation ; Funicular polygon ; Bending Moment and Shearing Force Diagrams ; jointed structures ; Stress Diagrams ; Roof Frame and Girder ; Loaded strings and chains.

Machines, Effort and Resistance, Mechanical advantage, Velocity ratio and Efficiency of machine, Rolling friction ; Journal friction ; Friction of Flat and V-band on pulleys ; Brakes.

E. M. 3. Engineering Mechanics :

Ch. E. 2nd
Year ; 6 hrs.
a week ;
Lecture.
2nd Semester.

Centre of parallel forces ; Centre of mass ; Centre of gravity ; Different states of equilibrium ; Theorem of Guldinus or Pappus ; Moment of Inertia ; Radius of Gyration ; Laws of rotation of rigid body ; Kinetic energy of rotation ; Kinetic energy of a rolling body.

Graphical statics ; Bow's rotation ; funicular polygon ; Bending moment and Shearing force diagrams ; jointed structures ; Stress Diagrams ; Roof frame and Girder ; Loaded strings and chains.

Law of machines ; Velocity ratio ; Mechanical advantage and efficiency of simple machines 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, spur gearing, wheel train, Rack and Pinion ; Crank and connecting rod mechanism, quick return motion, cams, ratchets.

E. M. 4. Strength of Materials and Theory of Structures :

M. E. 3rd
Year ; 4 hrs.
a week ;
Lecture.

Strength and resistance of Materials—Strain and stress, Elasticity, Rigidity, Stress Strain diagram, Resilience and Shock, Thin Cylindrical Shell subjected to internal pressure, Torsion, Angle of twist of a shaft, Moment and resistance of a shaft to torsion, Helical springs, Bending moment and Shearing force diagrams, Bending of beams under various loads, Bending and shearing due to travelling loads, Bending and shearing forces in different planes, Stress introduced due to bending and shearing, Moment of resistance to bending, Bending beyond elastic limit and

rupture. Deflection of beams, Deflections from bending moment diagrams, Deflection of beams having fixed ends, Propped up beams, Continuous beams and theorems of three moments, Resilience of Beams, Compound strain and stresses, Principal stresses due to combined bending and twisting, equivalent bending and twisting, Ellipse of stress, eccentric loading, bending combined with torsion and compression, Strength of a Ring, Poisson's ratio, Thick hollow cylinder subject to internal pressure, Column and struts, Euler's Theory of long columns, Rankine-Gordon Formulae for struts, Stress diagram for wind pressure, Roof-trusses, Beams and Girders.

Masonry structures, Retaining walls and Gravity Dams ; Reinforced Beams, Framed structures and foundation for Buildings.

E. M. 5. Strength of Materials :

Materials of Construction ; Physical and Mechanical properties, Characteristics and uses of Cast Iron, Steel, Non-ferrous Metals and alloys, such as, bearing metals, stellite, etc. ; Concrete, Wood, Fire-clay, Fire Brick Cement, etc.

E. E. &
Ch. E. 3rd
Year ; 3 hrs.
a week ;
Lecture.

Preservation of materials from natural decay—corrosion of metals and its prevention.

Simple stress and strain ; Elasticity, Rigidity, Hook's Law, Stress-strain diagrams ; Resilience and Shock.

Ultimate strength of materials, Working stress, Factor of safety, Thin cylindrical shell subjected to internal pressure, Rivetted joints.

Bending moment and Shearing Force diagram by analytical method for (a) Cantilevers and beams with single and multiple concentrated loads, and (b) Cantilevers and beams with uniformly distributed loads.

Torsional stress and Moment of Resistance of shaft to torsion.

Stress induced by Bending ; Moment of Resistance to Bending ; Neutral axis ; Section Modulus ; Deflection of beams in simple cases.

Compound stress and strain ; Principal stresses due to

combined Bending and Twisting ; Bending with Tension and Compression ; Eccentric Loading.

Poisson's Ratio ; Thick Cylinder subjected to pressure ; Euler's Theory of columns and struts ; Rankine Gordon formula for struts.

Application of the foregoing in the design of simple machine elements such as cylindrical vessels subjected to internal and external pressure, Rivetted joints, Bolts and nuts, screws, cotters, keys, couplings, Belts, Pulleys, Spur wheels, Shafts, Journals and Bearings, Worm and Wheel.

E. M. 6. Technical Dynamics :

Dynamics of Machinery, Effort, Acceleration and velocity diagram, Angular velocity diagrams, Piston or Slider and connecting rod velocity diagram, Piston Effort diagram, Crank Effort diagram, Forces in the Reciprocating parts, Fluctuation of Energy in Steam and Internal Combustion Engines, Fly-Wheel, Governor, Loaded Governors, Effect of Friction on Governors, Power, Effort and Sensitiveness of Governor and Balancing of Engine ; Vibration problems, Damped vibration ; Torsional vibration.

E. M. 7. Mechanism Drawing :

In this course students are required to solve by drawing problems on revolving and oscillating bodies, such as cranks, levers and four bar linkages etc. Transmission of motion by belts Ropes etc. ; Gears and Gear wheels ; Cams ; Aggregate combination etc.

E. M. 8. Engineering Materials and Processes :

Outline of manufacture of cast iron, wrought-iron and steel ; their physical and mechanical properties. Types of furnace ; Furnace linings ; Refractory materials. Products of iron and steel industry ; Production of parts by rolling, rolled, sections, sheets, strips etc. ; Wire drawing ; Manufacture of tubes.

Iron castings ; Cupolas, Blowers ; Air furnaces, Moulds ; Patterns and pattern making, Pattern requirements ;

M. E. 4th
Year ; 1 hr.
a week ;
Lecture.

E. E. &
M. E. 2nd
Year ; 4 hrs.
a week ;
Practical.
2nd Semester.

E. E. &
M. E. 1st
Year 4 hr.
a week ;
Lecture.
2nd Semester.

Moulding and core sand, properties of sand, preparation of sand ; Moulding machines ; Steel castings ; Electric furnaces ; Malleable castings ; Investment castings etc.

Methods of forging, Hammer forging, Drop forging and stamping, Power hammers and presses.

Oxyacetylene, Electric arc and Resistance welding Thermit welding ; Spot, Seam and Butt welding ; Welding machines.

Alloy steels, their properties and uses. High speed steels. Physical properties and non-ferrous metals such as copper, lead, tin, aluminium, magnesium, and their alloys such as brass, bronze, gunmetal, duralumin etc.

Soldering and brazing ; Autogenous welding of non-ferrous metals ; Metal castings, Die casting ; Extrusion of metals.

Timber ; growth and felling of timber, seasoning, preservation, principal uses, important varieties in use in India, veneers and plywood.

Bricks ; Stones ; Cement ; Concrete ; Lime and Mortars

E. M. 9. Engineering Computation :

Sketching of curves of different types, including Parabola, Hyperbola, Curves representing Exponential Functions, Catenary, Sine Curves and Simple Harmonic Motion, Compound Periodic Curves, Summation, Subtraction, Multiplication and Division of Curves. Graphical Solution of Simple Equations. Determination of Laws for Curves.

Practical ideas of differentiation. Graphical differentiation. Meaning of Integration ; Graphical Integration. Planimeter and its theory. Applications of Integration. Determination of First and Second Moment of Section by means of Graphical Construction. Nomography.

D. E. M. 1. Mechanics and Mechanism :

Measurement of Forces, Addition of Forces by Vectors, Triangle and Polygon of Forces, Resultant and Component of Forces, Moments, Couples, Crank and Levers, Centre of Gravity.

M. E. &
E. E. 2nd
Year ; 4 hrs.
a week ;
Practical.
1st Semester.

D. 2nd
Year ; 3 hrs.
a week ;
Lecture.

Laws of Motion, Velocity, Acceleration, Momentum, Impulsive Force, Work, Energy, Power, Measurement of Power, Brakes.

Circular motions and Simple Vibrations, Simple Frames, Principle of Work applied to Machinery, Friction and Lubrication, Inclined planes, Screws, Work lost in friction, Ball and Roller Bearings.

Simple Machines, Velocity ratio, Mechanical advantage and efficiency of Machines, Jack Screw, Pulley Blocks, Wheel and Axle, Lifting Machines.

Transmission of Motion and Power, Belt drive, Speed cones, Driving by chains and ropes, Friction gearing, Spur gearing, Rack and Pinion, Worm and Wheel.

Simple Mechanism, Crank and Connecting rod, Quick-return motion, Ratchets, Cams, etc.

D. E. M. 2. Applied Mechanics :

D. 3rd
Year ; 3 hrs.
a week ;
Lecture.

Moment of Inertia, Strength and Stiffness of Materials, Stress and Strain, Laws of Elasticity, Springs, Bending, Shearing and Twisting, Resistance to Bending, Shearing and Twisting, Jointed Structures, Stress Diagram, Roof-frame and Girder, Rivetted Joints and Pressure Vessels.

HYDRAULICS—Press, jack, accumulators, lifts, cranes, head, pressure, buoyancy, density.

RECIPROCATING PUMPS—Suction, Single and double acting force pumps.

WATER IN MOTION—Orifices, head, energy, flow, water wheels, turbines.

Venturimeter, Pitot tube, Current meters, etc.

O. E. M. 1. Applied Mechanics I :

O. 1st
Year ; 3 hrs.
a week ;
Lecture.

(1) Fundamental units.

(2) Motion :—Velocity and speed ; Linear velocity and acceleration ; Angular velocity, Circular motion ; Composition and Resolution of velocity ; Velocity considered as Vector ; Motion with uniform acceleration, Motion under gravity, Motion down a smooth inclined plane.

(3) Force, Inertia, Momentum, Laws of Motion ; Measurement of Force ; Concurrent and non-concurrent Forces ; Parallel Forces ; Couples ; Composition and Resolution of Forces ; Forces as Vectors ; Equilibrium of Forces ; Centre of gravity ; Determination of Centre of gravity.

(4) Work, Power, Energy.

(5) Application of the foregoing in Levers, Pulleys and Balances.

O. E. M. 2. Applied Mechanics II :

(1) Graphical Statics ; Funicular Polygon ; Bending Moment and Shearing Force in Beams, Roof frames and Stress Diagrams. O. 2nd
Year ; 3 hrs.
a week ;
Lecture.

(2) Electricity, stress, strain, Hooke's Law, Stress Strain Diagram, Elastic Limit, Ultimate stress, Working stress, Factor of safety.

(3) Bending Moment and Shearing Force Diagrams of Simple Beams and Cantilevers.

(4) Moment of Inertia, Moment of Resistance, Section Modulus, Neutral Axis, Stiffness of Beams, Deflection Formula in Simple cases.

(5) Rivet Joints in Frames and Structures, Columns & Struts.

MECHANICAL ENGINEERING

M. E. 1. Engineering Thermodynamics :

E. E. &
M. E. 2nd
Year ; 3 hrs.
a week ;
Lecture.

This course embraces the Study of the Principles of Thermodynamics governing the various forms of Heat Engines and Heat Producers such as :—Steam Engine, Steam Turbine, Oil and Gas Engines, Boiler, Compressors, etc., etc.

Heat units, Measuring Instruments, Laws of Thermodynamics, Mechanical Equivalent of Heat, Laws of Perfect Gases and their Characteristic Equation, Gas Constants and their Physical Significance, Specific Heats, two Specific Heats of Gases, Specific Heat of a mixture of gases, Relation between two specific heats of a gas and its constant, Internal Energy, Adiabatic, Isothermal and Polytropic expansion in general, Work done during Isothermal and Adiabatic expansion and compression of gases, Relation between Pressure, Volume and Temperature in Adiabatic and Isothermal changes, Carnot's and other Cycles, Reversible Engine, Condition of maximum efficiency and reversibility, Single and Multistage air-compressor, work required in a compressor, Air-Motors, Internal Combustion Engine Cycles. Fuels, higher and lower calorific values, other properties of fuels, combustion, coefficient of excess air, regulation of combustion from flue gas analysis, Formation of Steam, Properties of saturated and superheated steam. Internal energy, Total heat of Saturated and Super-heated steam, Quality of Steam, High pressure Steam, Critical pressure, Use of Steam Tables, Entropy chart for Water and Steam, Study of Mollier chart and its application in Steam Engines. Wire-drawing and throttling of Steam, Dryness fraction and its determination by Steam Calorimeters.

Steam Engine Cycles, Representation on P-V Diagrams and Entropy Diagrams, Flow of Steam through Nozzles and Orifices, Conversion of Pressure Energy into Kinetic Energy and *vice versa*, Pressure, Volume and Entropy diagram for expansion through Nozzles.

Other important vapours as used in Refrigerating Machine such as :— SO_2 , CO_2 , NH_3 , etc., etc., their Characteristics.

M. E. 2. Mechanism :

In this course instructions are given in the forms and motions of various mechanism independent of their strength. It is the purpose of this course to familiarise the students with the principles on which various mechanisms are designed.

Instructions in this course covers the following and are supplemented by drawing office exercises.

Revolving and Oscillating Bodies such as Cranks and Levers ; Transmission of Motion Belts, Ropes and Chains ; Transmission of Motion Bodies in pure Rolling contact ; Gears and Gear Teeth ; Gear Wheel in Trains ; Epicyclic Gear Trains ; Inclined Plane Wedge, Screw, Worm and Wheel ; Cams ; Four Bar Linkage ; Relative Velocities of Rigidly connected Points ; Link work ; Straight Line Mechanism and Parallel Motion ; Aggregate Combination ; Pulley blocks ; Intermittent Motion, etc., etc.

Application of above in actual machines.

M. E. 3. Heat Engines :

Heat, Absolute Temperature, Unit of Heat and Work, Horse-Power, Mechanical Equivalent of Heat, Transfer of Heat, two Specific Heats, Characteristic Equation of a Gas, Generation and Properties of Steam, Saturated and Super-heated Steam, work done by Steam in Expansion, Back Pressure, Mean Effective Pressure, indicated and Brake Horse power, Efficiency, Limit of Expansion, Cylinder Condensation, Clearance, Compounding, Effect of super-heating.

Types of Engines—Simple and Compound, Valve Gears, Lap, Lead and Angle of advance, Eccentrics, Valve-setting, Reversing Gear, Link Motion, Engine Details and Driving Mechanism, Flywheel and Governor.

Boilers and their Types, Boiler Mountings and Accessories, Economiser, Feed-water Heater, Feed pumps, etc.,

E. E. &
M. E. 2nd
Year ; 4 hrs.
a week ;
Lecture.
2nd Semester.

Ch. E. 2nd
Year ; 4 hrs.
a week ;
Lecture.
1st Semester.

Chimneys, Natural, Induced and Forced Draught. Condensers and Air Pumps.

Impulse and Reaction Turbines, Single-Stage and Multi-Stage.

Gas and Oil Engines, Working Cycles, Indicated and Brake Horse Power, Mechanical and Thermal Efficiency. Care and Management of Engines and Boilers.

M. E. 4. Steam Engine and Boiler :

M. E. 3rd
Year ; 4 hrs.
a week ;
Lecture.

A brief survey of principles of Thermodynamics as applied to Steam Engines, Properties of Steam, Behaviour of Steam in the Steam Cylinder, Wire drawing, Clearance, Composition, Cushioning, Cylinder feed, Initial Condensation, Action of Steam Jacket, Advantage of high speed, super-heating, Jacketting and Compound Expansion. Theoretical Indicator Diagram, Mean Effective Pressure, Indicated Horse Power, Steam Consumption from Indicator Diagram, Effect of Clearance, Expansion and Compression on economy, Relation between Steam Consumption and power, Willians Line, Study of Indicator and Indicator Diagrams.

Reciprocating Steam Engine Mechanism, Types of Reciprocating Steam Engines, Simple and Compound, Condensing and Non-condensing, Uniflow Engines, Reciprocating Steam Engine details.

Performance of Reciprocating Engines, Heat balance. Brake Horse Power, Mechanical Efficiency, Available heat, Steam Consumption and Equivalent Heat, Thermal Efficiency, Efficiency Ratio, Economy due to Superheating. Binary Vapour Engines.

Valve and valve Gears, Bilgram Diagrams, Zeuner Diagrams, Slide Valves, Piston Valves. Consequences of Early and Late Cut off, Meyer Expansion Valve, Movable Eccentric Stephenson Link Motion. Gooch and Allen Link Motion, Equivalent Eccentric, Corliss Valve, Drop Valves.

Dynamics of Reciprocating parts Piston or Slider Velocity Diagrams, Piston or Slider Acceleration Diagrams. Piston Velocity and Acceleration, Piston Effort and Piston Effort Diagrams, Crank Effort and Crank Effort Diagrams,

Forces due to Inertia of Reciprocating parts, Fluctuation of Energy, Fly-wheel.

Function of a Governor, Simple Conical Pendulum Governor, Loaded Governor, Effect of friction of Governors, Isochronism and Hunting, Sensitiveness of Governor, Effort and Power of Governor, Shaft Governors.

Performance of a Steam Boiler, Generation of Steam, Equivalent Evaporation, Heating Surface and Grate Area ; Boiler Horse Power, Operation and Efficiency of a Boiler, Heat losses in Boiler, Boiler lagging, Chimney Draught and Chimney Height, Artificial Draught, Force Draught, Steam-jet Draught.

Types and Classification of Boilers, Lancashire and Cornish Boilers, Locomotive Boilers, Water Tube Boilers, Boilers details, Boiler Mountings, Water Level Indicator, Pressure Gauges, Safety Valves, High and Low Water Safety Valves, Feed Check Valve, Boiler Accessories, Feed Pump, Injector, Feed Water, Heater, Gain due to Feed Water Heating, Economiser, Super-heaters, Chain Grate and Mechanical Stoking.

M. E. 5. Steam Turbine :

Principles of Thermodynamics as applied to Steam turbines, flow of steam through orifices and nozzles, Adiabatic flow, Polytropic flow, Critical pressure ratio and velocity ; Design of Nozzles, Use of Entropy chart in connection with Problems relating to Nozzles, Diffuser effect of Nozzles, Velocity Coefficient and Coefficient of Discharge and Efficiency of a Nozzle and the different methods of determining them, Velocity diagram and design of turbine blades. Thermodynamical Efficiency, Mechanical and thermal efficiency of a steam turbine, Types of turbines, Impulse, Reaction and combined Impulse and Reaction turbines, Simple stage and Multistage turbines, Pressure and Velocity compounding, Mechanical and Hydraulic losses in turbines, Testing of steam turbines, Commercial types of turbines such as De Laval, Terry, Curtis, Zoelly, Westinghouse, Parson, Thyssen-Röder, Allis-Chalmers, Kerr, Ljungstrom, etc., etc., Marine turbines,

M. E. 3rd
Year ; 2 hrs.
a week ;
Lecture.

Principle of Governing and types of Governors, Exhaust turbines, Bleeder turbines, Back-pressure turbines. Turbine Details, Leakage in Turbines, Labyrinth Packing.

M. E. 6. Internal Combustion Engine :

M. E. 3rd Year ; 2 hrs. a week ; Lecture.
Principles of Thermodynamics as applied to Internal Combustion Engines ; Otto, Diesel and other Cycles, Two Stroke and Four Stroke Cycle Engines, their different efficiencies, Comparative Study of these Cycles, Scavenging, super-charging.

Fuels in Internal Combustion Engines, Producer Gas Plant and Gas Generation.

Valves and Valve Mechanism, Ignition Devices, Injection systems, Reciprocating Parts, Bush, Bearings, Cylinder liner, frame, crankshaft, cylinder-head, base, etc., etc. Timing, Methods of Governing, Balancing, Cooling, Lubrication, Arrangements for Starting and Stopping, Types of Engines, Performance and Testing. Gas Turbines Theory & Performance. Theory of Jet Propulsion, Rockets.

M. E. 7. Prime Movers :

E. E. 3rd Year ; 3 hrs. a week ; Lecture.
Steam Engine, Fly wheel and Governor, Indicator, Dynamometer, Testing of Steam Engine, Performance and Efficiency, Application of the Laws of Thermodynamics to gases, vapours and gaseous mixtures, Internal combustion gas, oil and Diesel Engines. Flow of steam through nozzles, Impulse, Reaction turbines, Theory performance.

M. E. 8. Hydraulics :

E. E. & M. E. 3rd Year ; 2 hrs. a week ; Lecture.
Properties of Fluids ; Hydraulic Press ; Static Pressure of Fluids ; Pressure Heads ; Centre of Pressure ; Fluids in Motion ; Total Energy Bernoulli's Theorem, Radiating Current, Free Circular and Spiral Vortex, Whirling Liquids, Torricelli's Theorem, Flow of water through orifices, Flow of water over Notches and Weirs, Loss of Head due to sudden enlargement, contraction or obstruction in pipes, Flow through mouthpieces, Fluid Friction, Flow of water through open channels and pipes, Usual

and Critical Velocities, Friction and other losses in pipe line, Hydraulic Gradient, Flow of water through Nozzles, Power transmitted in a pipe.

Venturimeter, Pitot tube. Impact of a jet on fixed and moving Cups and Vanes, Reaction of a jet, Action of a jet on revolving Vanes.

Working and governing of Pelton-wheels, water-turbines, Single and Multistage Centrifugal pumps ; Piston, Bucket and Plunger pumps, etc.

M. E. 9. Theory of Machine Design :

This Course covers Physical Properties of Metals ; M. E. 3rd Year ; 2 hrs. a week ; Lecture.
Strength of Materials ; Study of the Statical and Dynamical Forces acting in various parts of Machines ; Theory of Design of Machine Parts such as Rivetted Joints, Cotters, Keys, Bolts, Nuts, Screws, Couplings Belts, Ropes, Chains, Pulleys, Axles and Shafts, Journals, Bearings, Gearing, etc. and Engine Parts such as Eccentric, Crank, Connecting Rod, Connecting Rod Ends, Cross-Head, Piston, Stuffing Box, etc., etc. Helical and other Springs, Thick Cylindrical Shell, Thin Cylindrical Shell subjected to Internal and External pressure, etc., etc.

M. E. 9A. Machine Drawing and Design (Elementary Course) :

In this Course the students are acquainted with the applications of Theory of Machine Design studied in Course M. E. 9, by means of suitable Problems on Design of Machine Parts such as Keys, Cotters, Bolts, Nuts, Screws, Helical and other Springs, Belts, Pulleys, Gears, Couplings, Axles and Shafts, Bearings, Journals, Hangers, Eccentrics, Stuffing Boxes, Connecting Rods, two ends of the Connecting Rod, Overhead Crank, Forged Crank, Rivetted Joints, Pressure Vessels, etc., etc.

M. E. 3rd Year ; 8 hrs. a week ; Practical.
The second part of the Course is devoted in Structural Design and each student is required to design at least one Roof-truss or one Bridge Girder, and one complete Hoisting Machine such as Travelling Cranes, Derricks, etc., etc.

E. E. 3rd
Year ; 5 hrs.
a week ;
Practical.

M. E. 9B. Machine Drawing and Design :

This is an abridged course of M. E. 9A.

M. E. 9C. Machine Drawing and Design :

Ch. E. 3rd
Year ; 3 hrs.
a week ;
Practical.

Design of Machine parts such as keys, Cotters, Bolts, Nuts, Screws, Helical and other Springs, Belts, Pulleys, Gears, Couplings, Shafts, Stuffing boxes, Rivetted joints, Pressure Vessels, Roof trusses, etc.

M. E. 10. Hydraulic Machines and Water Power Engineering :

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture
(Elective).

In this course theory and design of water turbines, Centrifugal pumps and utilisation of water power will be taken up. It will also embrace study of other water motors and hydraulic pressure machines used for commercial purposes.

Theory and principle of Impulse and reaction turbines, Types of turbines, Peltonwheel, Francis turbine, Propeller turbines with special reference to Kaplan turbine, Specific speed, Classification of turbine according to the direction of flow, General comparison of impulse and reaction turbines, General theory of turbine design, General case of radial, axial and mixed-flow turbine, Velocity diagram, Vane thickness and curvature of vanes, Losses, Efficiency and variation of efficiency with specific speed, Measurement of Head in turbine test, Characteristic curves for turbines, Model test, Governing, Surge tanks and the effect of governor action on surge.

Centrifugal pumps, Types and construction, General theory of centrifugal pumps, General equation and characteristic, axial thrust balancing of axial thrust on impeller shaft.

Other hydraulic motors such as overshot and undershot wheels etc., etc.

Piston, Bucket and Plunger pumps, Design of valves, theory of air vessels, Efficiency. Rotary pumps and other liquid-raising appliances.

Other hydraulic machines used for commercial purposes

such as hydraulic Rams, Presses, Accumulators, Intensifiers, Elevators, Riveters, etc., etc.

M. E. 11. Power Plant Engineering :

This course deals with Design, Operation and Economics of Power Plants, Cost of production and distribution of Power and determination of Rates.

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

Location of plants ; Study of Power Plants and Buildings ; General Lay-out, Erection, Initial cost, Operating Expenses and maintenance. Study of performance of Power Plants by recording Apparatus and Gauges.

Theory of Heat transmission and its application to the design of heating surface or cooling surface in Boilers, Evaporators, Condensers, Furnaces, Coolers, etc.

Steam Power Plant :—Supply, handling & storing of fuels, preparation of fuels, mechanical stoker, natural and artificial draft, Chimneys, influence of draft on evaporation, Boiler specification, heating surface, grate area, Boiler mountings, Boiler accessories, Flue chamber, Damper, Steam pipes, Water pipes, Pipe fitting, lagging, feed water heater, Economiser, Water softening, Superheater, Boiler losses, Boiler performance, Boiler regulation.

Selection of Prime movers, their performance, composition of prime movers.

Condensers and Air Pumps :—Types of Condensers, Parallel Flow and Counter Current Jet Condensers, Surface Condensers, Amount of Water for Condensation of Steam, Condenser Efficiency, Sources of Air in condenser, Function and Types of Air Pumps, Combined Wet and Dry Air Pump, Vacuum Augmenter, Air Pump Capacity, Rotary Air Pump, Steam Air Injector, Cooling Towers.

Cooling arrangements for generators.

Diesel Power Plant :—Equipment of Diesel Plants, suitability of Diesel Equipment of Diesel plants, cost of operation, cooling systems, re-cooling arrangements, starting device, performance of Diesel Engine, care of Diesel plants.

Hydro-electric Plant :—Selection of suitable site advantages and disadvantages and capacity of Hydrostation ;

factors on which the capacity depends, Prime movers, their characteristics and performances, hydro-electric survey, flow, fall, catchment, reservoir, rainfall, run-off etc.

M. E. 12. Motor-car Engineering :

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture
(Elective).

Gasoline Engines and Cycles, Valves and Valve operating Mechanism, Horsepower of Engines, Types of modern Auto-Engines. Fuels, Principles of Carburetting, Types of Carburetors, Governing. Engine Lubrication and Cooling Systems, Radiators. Producer-gas engines.

Ignition Systems, Magnetos, Types of Magnetos, Spark Plugs, Care and Maintenance of Magneto and Battery Ignition System. Automobile Storage Battery, Charging and Discharging, Starting and Lighting System, Head Lamps and Reflectors.

Automobile Chassis, Frames, Springs and Spring Suspension, Front Axle, Steering Mechanism, Brakes, Clutches, Change Gear Sets, Universal Coupling and Transmission, Types of Rear Axles, The Differential Wheels, Rims and Tyres. Automobile Troubles and Remedies. Preparation of Starting Operation and Care. Efficiency Test. Design of Engine Parts, Frames and Chassis.

M. E. 13. Machine Tools :

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

The importance and development of Machine Tools, Examination of the finished article, Measuring system of Machine shop, Setting up of Machine Tools, Method of work, Feed, Cutting speed, Power required, the Driving System, Changing of Speed, Principles and Design of Rotary Machine Tools such as :—Simple and Screw-cutting Lathes, Turret Lathes, Semi-Automatic and full Automatic Lathes, Drilling Machines Single Multispindle, Horizontal Boring Mills, Vertical Boring and Turning Mills, Cylinder Boring Machine, Milling Machine, Plane and Universal, Vertical Milling Machines, Different types of Gear Cutting Machines, Grinding Machines and methods, Special Screw Cutting Machines, etc., etc.

Reciprocating Machine Tools such as :—Shaping Machines, Planning Machines, Slotting Machines, Bevel

Gear and Spur Gear Shaping Machines, Key-seating Machines, Plating edge Shaping Machines, etc., etc.

Machine Saws such as :—Circular Saws, Band Saws, etc., etc., Shearing Machines, Punching Machines and Presses.

Testing of Machine Tools. Economical Utilisation of Machine Tools.

M. E. 14. Metallography and Materials of Construction :

Measurement of mechanical properties and strength of materials and their inter-relations *viz.*, tenacity, hardness, ductility, impact resistance, fatigue resistance, creep etc. M. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

Testing equipments.

Structure of ferrous metals. Effect of grain size on strength ; Metallography of ferrous metals.

Effects of various ingredients on steel and cast iron ; Physical constitution of steel ; Iron carbon diagram and solid solutions ; Effect of temperature and mechanical working upon grain size and strength of steel. Heat-treatment of steel and its effect ; Hardening, tempering, normalising, annealing, case hardening etc. and their effects on structure.

Heat treating furnaces and equipments ; Equipments for measuring high temperatures.

Bearing metals, babbitt metal, bronze, silver base alloys and other alloys for bearings. Hard metals for cutting tools such as Stellites, Tungsten Carbides etc. Important metals used for thermocouples.

Power metallurgy, industrial use of powder metallurgy ; Abrasives ; Grinding wheels ; Coated papers and cloths.

Corrosion and its prevention, Nonmetallic castings, Spray paintings, Dipping, Metal spraying etc.

Lubricating materials and lubricants, their suitability and use, properties and methods of testing.

Insulating materials for building, refrigerators, cold storage, steam pipes etc.

Study of materials used in belt, rope and cord

manufacture, packing materials, asbestos fibres, asbestos cords, leather, rubber, guttaperchas etc.

Plastic and their industrial applications.

M. E. 15. Mechanical Handling of Materials :

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

Different types of Elevators and Lowerers for handling material in bulk and for large objects. Their speed and tightening gears ; Worm, Push Plate, Pushrough and Band Conveyors. Picking Belts ; Reciprocating Conveyors ; Gravity Shoots ; Roller Runways ; Hopper ; Stacker and Gadget ; Automatic feeding Devices ; Pneumatic Handling of Materials ; Endless Rope and Chain Haulage ; Aerial Ropeways ; Cable Cranes ; Mono-rails and Telphers ; Blast Furnace Hoists ; Unloading of Railway Wagons ; Skips, Grabs ; Lifting Magnets ; Hand and Electric Cranes ; Locomotives Cranes ; Wharf Cranes and Transporters.

M. E. 16. Factory Organisation and Management :

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

Factory Location, Influence of Sale Market, Raw Materials, Labour and Transport, Planning of Factory, Internal Transport, Possibilities of Expansion, Equipments, Staff and Departmental Organisation, Functional organisation, Control, Departmental Report, Central Office, Location of various departments and their relations, Division of work, Advertisement and Sale, Designing and Drafting, Research and Testing Laboratories, Estimating, Purchase, Stores, Production, Planning and Production, Tools, Measuring instruments, tolerance, standardizations, Jigs and Fixtures, Inspection and Checking, Assembling and Testing.

Cost accounting, material and labour costs, overhead charges, costs, accounting, Factory costs and Inventory.

Labour and labour problem, management of labour, wage systems, Strike, Welfare methods, apprenticeship system, Factories and Engineering Institutions.

Factory Laws, Industrial Finance.

M. E. 17. Refrigeration :

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture
(Elective).

Refrigeration Methods ; Systems of Mechanical Refrigeration ; Air System, Compression System, Absorption System,

adsorption system. Refrigerants and their Properties—pressure and boiling point, latent heat of evaporation, inflammability, effect on metals, effect on lubricants ; Testing for leaks ; Refrigeration unit ; Capacity of a refrigeration system.

Household refrigerators and their characteristics ; Refrigerator details and accessories—liquid receivers, expansion valve, evaporator, condenser, absorber, rectifier etc. ; Compressors of refrigerating plants.

Operation of refrigerating system—Starting and shutting down of compressor ; Charging refrigerant in the system ; Testing of leakage ; Operating practice for absorption system.

Insulation, Insulating materials, Heat transmission through walls, Refrigeration load.

Thermodynamics of refrigerating system ; Work of Compression, P-V diagram T- ϕ diagram ; Effect of superheating and undercooling ; wet compression ; Power required for Compression. Co-efficient of performance. Refrigeration Cost and Plant testing.

Ice-making—Can system and plate system ; Raw water ; Removal of core water from ice ; Defects of ice ; Refrigeration per ton of ice.

Eutectic ice, Sodium Chloride and Calcium chloride brine.

Cold Storage—Construction, Insulation ; Insulating materials and their properties ; Heat transfer through composite walls ; Calculation of refrigeration required.

Air circulation and ventilation in cold storage ; Natural and forced circular ; Cold storage of foods.

M. E. 18. Air Conditioning :

Atmosphere, its nature, air and water vapour mixture ; Law of partial pressures.

Psychrometry ; Dry and Wet bulb temperatures, Dew-point, Relative humidity, Psychrometers, Psychrometric Chart.

Requirements for comfort ; functions of Air Conditioning ; Ventilation requirements, Comfort Charts.

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture
(Elective).

Air-conditioning systems, component parts ; Winter Air Conditioning, Summer Air Conditioning ; Year-round Air Conditioning equipment ; Central air-conditioning system.

Winter Air-conditioning load ; Air infiltration, heat loss, Heat transmission loss ; Total heating and humidifying load.

Heaters ; Warm Air heating system, Hot Water heating system, Steam heating system, Radiators, Unit Heaters.

Humidifiers, Air filters ; Application of Winter Air-conditioning Equipment.

Mechanical Refrigeration system.

Summer Air-conditioning load ; Air infiltration heat and humidity gain. Heat transmission and sun-light heat gain ; Heat and humidity gain from human occupants, Heat gain from electric lights, motors, etc.

Dehumidifier, Absorbers, Application of Summer Air-conditioning equipment.

Temperature and Humidity control ; Thermostats, Humidistats ; Zone controls.

M. E. 19. Machine Drawing :

Ch. E. &
Engg. 2nd
Year ; 6 hrs.
a week ;
Practical.

Machine Sketching (Orthographic and Isometric) ; Making of Assembly and Working Drawings from Sketches ; Preparing Detailed Working Drawings from Assembly and Assembly Drawings from Details ; Reading and Checking of Drawings ; Empirical Design of Standard Machine Parts.

M. E. 20. Machine Design :

M. E.
4th Year ;
10 hrs.
a week ;
Practical.

In this course complete design of two machines will be required of each student. The student will be given option to select any two from the following of which at least one must be a Prime-Mover : (1) Design of reciprocating Steam Engine, (2) Design of Internal Combustion Engine, (3) Design of Steam Turbine, (4) Design of Water Turbine, (5) Design of Steam Boiler, (6) Design of Pumps or Compressors, (7) Design of Machine Tools.

M. E. 21A. Mechanical Engineering Laboratory :

M. E. 3rd &
4th Year :
3 hrs.
a week ;
Practical.

This course is meant for the Third and Fourth Year students of the Mechanical Engineering course and is intended to familiarise them with the practical application of the theories taught in lecture courses in Applied Thermodynamics, Steam Engines, Steam Boilers, Steam Turbines, Gas Engines, Oil Engine, Gas Producer, Hydraulics, Hydraulic Machinery (Pumps and Water Wheels etc.), Mechanism, Applied Mechanics (Strength and Resistance of Materials), by suitably arranged series of graded experiments and to acquaint them with methods of commercial testing of Prime Movers, Boilers, Gas Producers, Pumping Machinery and Engineering Materials.

Work in this course includes the following :—

Calibration, Adjustment and use of Instruments and Meters, such as Planimeters, Thermometers, Pyrometers, Water-meters, Gas-meters, Pressure and Vacuum Gauges, etc., used in Mechanical Engineering work ; Determination of Calorific value of Fuels (Solid, Liquid and Gas). Testing of different types of machines for lifting. Determination of Bearing Friction etc., Moment of inertia of fly wheel.

Taking of Indicator Diagrams, Valve Setting ; Location and Correction of Defects in Steam, Oil and Gas-Engines, etc., etc. Running and management of Engines, Boilers and Pumps, etc. ; Determination of Indicated and Brake Horse Power, Fuel and Steam Consumption of Engines and Turbines ; Economy and Efficiency Tests of Engines, Turbines and Boilers ; Heat Balance, Complete Testing of Steam Power Plant.

Determination of coefficient of sliding friction ; Angle of friction ; belt friction ; bearing friction ; bearing friction losses ; moment of inertia of fly-wheel by method of rotation and oscillation ; Mechanical advantage and efficiency of various mechanisms such as pulley blocks, Jack screw, wheel and axle, differential wheel and axle, crabs and winches etc. ; determination of law of machines.

Calibration of Tank, Measurement of Flow of Water ; Determination of Critical Velocity ; Efficiency Test of Centrifugal and Reciprocating pumps.

Tension, Compression, Bending, Shearing, Hardness and other tests of Cast iron, Wrought iron, Steel, etc., Testing of Wires and Ropes under Tension, Testing of Helical and Laminated Springs, etc.; Testing of Cement and other Engineering Materials.

In this course a report is required of each student on every experiment.

E. E. 3rd
Year; 3 hrs.
a week;
Practical.

M. E. 21B. Mechanical Engineering Laboratory :

This is an abridged course of M. E. 21A.

Ch. E. 4th
Year; 3 hrs.
a week;
Practical
(8 weeks).

M. E. 21C. Mechanical Engineering Laboratory :

This is an abridged course of M. E. 21B.

M. E. 22. Abstract.

For Mechanical Engineering Fourth Year Class

M. E. 4th
Year; 2 hrs.
a week;
Recitation.

In this course each student will be required to write an article of about 2000 words on a current engineering topic assigned by the teacher and give a concise talk on the subject for 10 minutes in the class, by rotation. The result of these assignments will be considered as that of practical work. There will be no written examination for this course.

M. E. 23. Railway Engineering Mechanical :

Conditions governing the performance of Locomotive Engine, Climate. Civil Engineers Specification, Traffic Managers requirements.

M. E. 4th
Year; 2 hrs.
a week;
Lecture.
(Elective).

Boiler Power, Boiler Horse Power, Estimation of Radiant Heat in the fire Box of a locomotive by Stefan Boltzman Law. Determination of the temperature of Furnace.

Tractive force formula for two cylinder Engine. Definition of Mechanical Efficiency of two cylinder Engine. Indicated Horse Power to be calculated from tractive force and speed. Resistance to be overcome by the Engine & train.

Adhesion. Factor of Adhesion, Draw Bar Horse Power. Rail Horse Power, Cause of Wheel slipping and

its prevention. Determination of the number of coupled axles when tractive force and weight of Rail per yard is given. Cylinders and valves. Principles of Stephenson's Link motion. Walschaert Valve gear. Cam operated Lentz and Caprotti Gear.

Locomotive Boiler with fittings and Accessories. Smoke Box, Blast Pipe Principles of Injector. Pulverised fuel firing.

Railway wheels and axles and fixing tyres by method of shrinkage, Frame axle Box and Spring, Vacuum Brake and Brake Gearing, Lubrication of parts by sight feed and Mechanical Lubricator.

Rail Friction and steam sanding gear, Garatt system of Heavier type Locomotive.

Turbine locomotives and Diesel Locos, Construction of carriages and wagons. Laminated Bearing Spring, Semi elliptical type. Sanders formula for deflection per ton and safe working load.

Books followed :

Locomotive management—Hodgson & Lake.

Locomotive of today—Locomotive Publishing Co.

Locomotive Engineers Pocket Book—Locomotive Publishing Co.

Locomotive Design Data and Formula—Philipson.

Railway Carriage & Wagon Hand Book—Locomotive Publishing Co.

Heat Engine—D. A. Low.

Lubrication of Loco—by Bhrouss.

M. E. 24. Boiler and Power Plant :

Heat transmission in Boiler furnace. Steam Boilers. Various Types. High Pressure Steam Generation. Boiler Mountings and accessories Feed Pumps. Chimney Draught. Boiler Performance. Boiler house equipments. Different types of grates and stokers. CO₂ recorder and other measuring instruments. Feed heating. Water

E. E. 4th
Yr. 2 hrs.
a week
Lecture.

softening Plant. Superheater. Economiser. Fuel handling Plant. Circulating Water.

Economics of Steam Plant condensers, cooling power Air pump. Oil Engine Plant and Hydro Electric Plant Economics. Fundamentals of Station Design. Works Buildings. Pipe work. Station costs and organisation Load Division. Incremental Rate Curves.

M. E. 25. Quantity Production and Methods :

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture
(Elective).

System of production, mass production, interchangeability of machine parts, tolerances, fits and standardisation, measuring instruments for mass production and checking, measurement of quality.

Machine tools for mass production viz. Automatic Screw Machine, Gear Cutting Machine, Gear Grinding Machine etc.

Design of cutting tools, application of machinability to cutting practice.

Jigs and fixtures, Economic principles, Principles of design, Locating schemes, Clamps and clamping methods, Standard bushing, Design of standards, Types of jigs and fixtures, Welded, Cast-iron and light metal fixtures ; Pneumatic fixtures.

Press work, Products manufactured by metal stamping, Blanking, Piercing, Perforating etc., Blanking & Cutting dies, Design Principles of dies and punches, Progressive dies.

Plastic metal working, forgoing, drop forging, bending, forming, embossing and drawing operations and Die design principles, Types of presses, accessories and attachments, selection of presses.

Die casting and plastic moulding methods, Products manufactured by Die casting and plastic moulding. Die casting and plastic moulding machines.

Relative costs of different production methods.

M. E. 26. Production Planning :

M. E. 4th
Year ; 2 hrs.
a week ;
(Elective).

The name of the subject will be "Production Planning". It will be a two periods per week lecture course and three

periods per week practical by arrangement with the teacher. The outline of the course will be as follows :—

Planning of work, Routing, Scop of routing, Interrelation of routing, Classification and layout, Preparation of routine sheets, Combination routing, Schedule of time, Master of schedules, Machine load and load charts, Machine operations, Cutting speed and feed, Machine time and handling time, Production planning in standard quantity manufacture, Machine capacity and selection, Time and motion study, Inspection and quality control, Estimation and costing.

D. M. E. 1. Heat Engines, Boilers, Pumps and Auxiliary Machine :

Heat, Absolute temperature ; Units of heat and work ; Horse power ; Mechanical equivalent of heat ; Transfer of heat ; Two specific heats ; Characteristics of a gas ; Expansion of gases ; Generation and properties of steam ; Saturated and superheated steam ; Work done by steam ; Back pressure ; Mean effective pressure ; Indicated and brake horse power ; Efficiency ; Limit of expansion ; Cylinder condensation ; Clearance ; Compounding ; Effect of super-heating.

Types of Engines ; Simple and compound ; valve gears ; lap, lead and angle of advance ; Eccentrics ; Valve setting ; Reversing gear ; Link motion ; Engine details and driving mechanism ; Flywheel and governor.

Boilers and their Types ; Boiler mountings and accessories ; Economiser ; Feed water heater ; Feed pumps ; Chimneys and natural, induced and forced draught. Auxiliary machines ; Condenser ; Wet and dry air pump ; Circulating pump, etc.

Impulse and reaction turbines of single and multi-stage. Gas and Oil engines ; Working cycles ; Indicated and brake horse power ; Mechanical and thermal efficiency.

Erection, care, operation and management of engines, turbines and boilers.

Piston and centrifugal pumps and compressors, their care, maintenance and operation.

Text-book :—Heat Engines—Ripper.

D. 3rd
Year ; 4 hrs.
a week ;
Lecture.

D. M. E. 2. Power House Practice :

D. 3rd
Year ; 3 hrs
a week ;
Practical.

Taking indicator diagram ; Valve setting ; Location and correction of defects in steam, oil and gas engines ; Starting ; Running ; Care and maintenance of Engines, Boilers, and Pump including centrifugal pumps.

Attending Power-house and switch-board and recording of Logsheets.

O. M. E. 1. Elementary Mechanical Engineering :

O. 3rd
Year ; 3 hrs.
a week ;
Lecture.

Fastenings—Boilers—Common types and their description and uses—Erection and inspection—Arrangement and lagging heat engines—Description of the simple types—foundations and erection.

Internal combustion engines—description of petrol, oil and gas engines—foundations—location and running faults.

Hydraulic machinery—common type of reciprocating and centrifugal pumps—Turbines.

Power transmission—by belts, gearing, ropes, chain and friction drives.

WORKSHOP PRACTICE

In workshop courses, instruction and training are given through assigned readings, lectures, demonstrations and carefully planned and graded practical exercises in different shops.

W. 1. Carpentry and Moulding :

Use of Carpenter's and Joiner's tools, Sawing, Planning, Making of Joints, Wood turning, Chiseling, Boring, Laying out of work, Jig, Band and Circular Sawing.

E. E. &
M. E. 1st
Year ; 3 hrs.
a week ;
Practical.

The use of various Moulder's tools, Cutting over, tempering and mixing foundry sand and loam, making two and three parts green sand mould from pattern supplied ; sweep moulding and pipe moulding ; making, backing and testing Core ; preparing and charging Cupolas and casting.

Study of large Flood and Sweep moulding, Steel casting, Foundry appliances and modern methods of foundry production, etc., etc.

W. 2. Patterns and Forging :

Pattern making consists of designing wood pattern from working drawing and pattern construction. The course includes patterns of pipe fittings, Pulleys, Hangers, Gears, Valves and Machine parts, etc., etc. It also includes the study and construction of spirit and loose piece of patterns ; large, complete, part, skeleton, patterns for floor, loan and sweep work, metal pattern, etc., and making of core boxes. The use of handling of blacksmith's tools ; Laying and managing fires, heating, drawing, bending, forming, twisting, upsetting, bending while upsetting, upsetting of square corners ; bolt making, punching, chamfering, construction of hooks and ring bolts ; tempering, spring and tool making, study of the use of power hammer, study of the physical properties of iron, steel and other metals, heat treatment of steel, tool making, etc., etc.

E. E. &
M. E. 2nd
Year ; 3 hrs.
a week ;
Practical.

W. 3. Fitters Shop :

M. E. 2nd
Year ; 3 hrs.
a week ;
Practical.

Laying out work ; chipping, filing and fitting, angles of cutting tools, chipping of key-ways, grinding, drilling, production of plane surfaces by hand methods, fitting parallel parts together, lining and making off, tapping, stud fitting ; fixing pulleys in position, etc., etc.

W. 4. Machine Shop :

M. E. 3rd
Year ; 6 hrs.
a week ;
Practical.

Turning and boring steel, wrought iron and cast iron from working drawings, face plate and chuck work, outside and inside screw cutting, use of various tools, study of cutting angles, speed and different feeds suitable for each tool, machine and material, centering, squaring, taper turning, reaming, finishing, polishing, drilling, tapping, mandrel making, grinding, lapping plane, flat, and V-surfaces, the use of Milling machines, gear cutting, tool-making, making of taps, drills, reamers, Milling cutters and gauges, etc., etc.

In this course every student is required to work on modern standard machine tools such as lathes of different types, planing machines, grinding machines, slotting machines, shaping machines, etc., etc.

The students are required to study and use different measuring tools and devices with their advantages and limits of accuracy.

Instruction is also given whenever necessary in the mechanism of the standard machines found in modern factories and the attention of the student is drawn to the various possible adjustments for different works.

W. 4A. Machine Shop :

This is an abridged course of W. 4.

W. 5. Advanced Workshop Practice :

E. E. 3rd
Year ;
3 hrs.
a week ;
Practical.

M. E. 4th
Year ; 6 hrs.
a week ;
Practical.

In this course the students will be taught to apply the principles studied in other workshop courses in Commercial production of finished articles from crude materials. Each class will be required to manufacture some useful

articles and at least one complete machine or a standard machine tool from the drawing supplied.

D. W. 1. Carpentry :

Use of Carpenter's and Joiner's tools ; Sawings ; Planing and making of joints of various kinds ; Wood turning ; Chiselling ; Boring, Laying out of work ; Jig, band and circular sawing.

D. 1st
Year ; 6 hrs.
a week ;
Practical.

Foundry Work and Moulding :

The use of various moulder's tools ; Making two and three parts green sand mould from pattern supplied ; Sweep moulding, pipe moulding ; Making, packing and testing core ; Preparing and charging cupolas and casting.

6 hrs.
a week ;
Practical.

D. W. 2. Forging :

The use and handling of Blacksmith's tools ; Laying and managing fires ; Heating ; Drawing ; Bending ; Forming ; Twisting ; Upsetting ; Bolt making ; Punching ; Chamfering ; Construction of hooks and ring bolts ; Tempering and tool making ; Use of Power-hammer ; Different methods of welding ; etc.

D. 2nd
Year ; 6 hrs.
a week ;
Practical.

Pattern Shop :

Making of wood patterns from drawings ; The course includes patterns of pipe fittings, pulleys, hangers, gears, valves and machineparts ; Core box and Core fitting, etc.

6 hrs.
a week ;
Practical.

D. W. 3. Fitting Shop :

Chipping ; Filing and fitting ; Angles of cutting tools ; Chipping of key-ways ; Grinding ; Drilling ; Production of plane surface by hand methods ; Fitting parallel parts together ; Stud fitting ; Fixing pulleys in a position, etc.

D. 3rd
Year ; 6 hrs.
a week ;
Practical.

Machine Shop :

Turning and boring steel, wrought iron and cast iron from working drawings ; Face plate and chuck work ;

6 hrs.
a week ;
Practical.

Outside and inside screw cutting ; Use of various tools ; Study of cutting angles ; Speed and different feeds suitable for each tool-machine and material ; Centering ; Squaring ; Tapering ; Reaming ; Finishing ; Polishing ; Drilling ; Grinding, etc.; The use of Milling machines ; Gear cutting, etc.

O. 3rd
Year ; 6 hrs.
a week ;
Practical.

O. W. 1. Workshop :

Smithy and Carpentry as in W. 1 and W. 2.

Ag. W. 1. Workshop :

Agri. 1st
Year ; 6 hrs.
a week ;
Practical.

First term—Wood work, selection, use and care of tools, selection of wood for definite purposes, preservation against termites and decay, use of drawings as guide to construction, making of simple objects. The major part of the work is definitely related to agricultural work.

Second term—Metal work, selection, use and care of tools, study of metals used in machinery, characteristics of each, pipe work, simple forging, hardening and tempering, soldering and brazing, rope splicing, belt lacing and general repair principles.

GENERAL STUDIES

G. 1. English :

Ch. E. &
Eng. 1st
Year ; 2 hrs.
a week ;
Lecture.
1st Semester.

G. 2. Modern World I :

History of the modern world from 1789 to 1939 *i.e.*, from the French Revolution to the outbreak of the World War II. Students will be expected to have only an *outline knowledge* of the history of the Modern World, with special reference to the following topics :—

Ch. E. &
Engg. 1st
Year ; 2 hrs.
a week ;
Lecture.
2nd Semester.

1. French Revolution.
2. Career of Napoleon Bonaparte.
3. Vienna Settlement and the history of Europe from 1815 to 1850.
4. Crimean War.
5. Unification of Italy.
6. Unification of Germany.
7. Scramble for overseas empires.
8. Period of Armed Peace.
9. World War I (1914-18).
10. Peace settlements and Post-War Europe.
11. History of the Socialist movement.
12. Russian Revolution and the rapid development of the U.S.S.R.
13. Rise of a new Turkey under Kemal Pasha.
14. History of Egypt from the first British occupation to the Anglo-Egyptian Treaty of 1936.
15. History of the Arab World in the Post-War period (Syria, Lebanon, Palestine, Transjordan, Saudi-Arabia and Iraq).
16. India ; (a) Growth of the Nationalist movement.
(b) Constitutional development,

17. China and Japan—(from about the middle of the 19th century to the present day).
18. The U.S.A.; (a) A rapid survey of the development of the Federation.
(b) Policy of Expansion.

G. 3. Modern World II :

- (a) Fundamental Principles of Politics and Outlines of the Constitutions of the important countries.
- (b) Indian Economics.

Under (a) will be included—

General Theories about State, Government, Functions of Government, Organs of Government, Types of Government, Different kinds of Constitution, Public Opinion, Party System, Local Government, Public Services, International co-operation.

Indian Constitution and Government.

Broad Outlines of the Constitution of Great Britain, the U.S.A. and the U.S.S.R.

Under (b) will be included—

Trade Union Movement, Labour Legislation, Banking and Currency, Foreign Trade, Government Policy regarding Industrial Development and Tariff with respect to protection of infant national industries, Public Finance including the effect of the existing taxation policy on the Development of Industries.

G. 4. Engineering Economics :

Wealth, Capital, Income, Economic Law, Increasing and diminishing Returns, Cartels, Trusts Desire and utility, Law of diminishing Utility, Law of demand, Elasticity of demand market prices, market speculation, short period long period monopoly. The theory of money, functions of money, Gresham's law, inflation and deflation. The Doctrine of comparative costs, the relations of imports to

exports, Foreign exchanges, Rent, Quasi-Rent, Profits ; Interest and wages.

Interest and annuity, certain accumulation at compound interest, nominal and effective rates, present values, discount, sinking fund, amounts, and present values of annuities certain. Loans payable by terminable annuities, Book-keeping and accounting, Recording transaction in Cash-book, Invoice-books, Sales Day-book, Purchase returns, Sales returns, Journal and posting them into Ledgers, preparation of trial balance, trading account, profit and loss account, and balance sheet, cost accounting and costing method, methods of labour remuneration, various piece work systems and premium Bonus schemes, overhead classification, fixed and variable expenses, form of expense analysis of a factory, administration, selling and distribution expenses, Departmental overhead allocation to product, distribution of cost or overhead expenses and their computation, job or terminal costing, process costing, unit or single out-put cost, study of fatigue, work and rest periods, study of movements, Elimination of unnecessary movements.

G. 5. General Geology and Dynamical Geology :

Study of the general principles of geological phenomena, study of minerals and specially the rock-forming minerals. Volcanoes and igneous actions, Igneous rocks, sedimentary rocks and metamorphic rocks. Movements of the earth and the earth structure. Structural geology—definitions of different structural features and geometrical problems, folding and faulting. Elementary stratigraphy and elementary palaeontology. Geological maps and sections.

Laboratory work—map reading, drawing of sections, identification of common rocks, minerals and fossils.

G. 6. Engineering Geology :

Choice of materials for engineering operations,—sands, clays, pebbles, building materials like sand-stones, lime-stones, laterite etc. Preservation of building stones, road

Ch. E. &
Engg. 2nd
Year ; 2 hrs.
a week ;
Lecture,
1st Semester.

Engg.
4th Year ;
2 hrs.
a week ;
Lecture.

M. E. &
E. E. 4th
Year ; 2 hrs.
a week ;
Lecture.

M. E. 4th
Year ; 2 hrs.
a week ;
Lecture
(Elective).

metals like basalt, dolerite etc. Elementary notion about quarrying, tunnelling and mining operations. Drilling of different types of rocks, study of different parts of the machinery and engine required for running various types of drilling machines.

Geology applied to hydro-electric projects—construction of dams on different types of rocks. Earth dams, concrete dams, flood dams etc. Geological materials used in building dams. Revetments, quay walls, protecting walls, erosion walls, breakwater, earthquake considerations affecting the site of dam construction. Study of the geological considerations regarding the proposed dams in different parts of India.

Water prospecting and tube-well problems. Quality of water, surface water and underground water, boiler-feed water, water for sanitary purpose, drinking water, etc.

Industrial minerals and rocks, Origin, occurrence of metallic and non-metallic minerals of economic importance. Study of coal-fields of India and geology and mineralogy of coal substance. Gasification of coal—underground and surface. Petroleum geology—chemical and physical properties of petroleum, origin and accumulation of petroleum and natural gas, reservoir rocks, petroliferous provinces of India and other parts of the world.

D. 1st
Year ; 1 hr.
a week ;
Lecture.
D. 2nd
Year ; 2 hrs.
a week ;
Lecture.
O. 3rd
Year ; 2 hrs.
a week ;
Lecture.

D. G. 1. English

D. G. 2. Business English

O. G. 1. Accountancy

OVERSEER COURSE

O. 1. Survey :

Principles of Surveying, Chain Survey, Methods of Chaining ; obstacles and sources of error and how to avoid them. Compass Survey ; Methods of Surveying ; Field book ; Methods of plotting ; Working in magnetic areas ; Traverse along road, river, etc.

Plane Table Survey :—Equipments, Methods, Sources of error, Relaying a missing station.

Levelling :—Y-level, Reversible levels and Dumpy levels ; Temporary and permanent adjustment ; Method of running a line of levels, Sources of error ; Stadia reading ; Curvature and refraction ; Field book ; Bench Mark ; Datum level ; Limits of error.

O. S. 1. Surveying I :

Definitions, Principle of surveying, History, Instruments and their constructions (Chain, Compass, Levels, Optical squares, Cross staff).

Chain Surveying :—Testing of chain, Hand sketch, Selection and marking of station points ; Ranging lines, Method of chaining. Methods of surveying. Obstacles and sources of error and how to avoid them. Plotting, Useful problems.

Compass Survey :—Method of surveying. Field book, variation, sources of error and how to avoid them, where recommended, Different methods of plotting, Closing error, Graphite adjustment and by calculation, Working in magnetic areas. Traverse along road, river, etc.

Plane Table Survey :—Equipments, Mounting paper, Method of surveying, Interior fillings, sources of error, Advantages and disadvantages, Finding one's place, Relaying a missing station.

Cadastral Survey :—Basis, method of surveying, Duty

of traverse party, Surveyors' and Amins' duty to fill the Interior fillings.

Levellings :—Y. Reversible and Dumpy levels, Temporary and permanent adjustments, Objects of levelling, Different classes, Method of running a line of levels, Sources of errors, Difficulties and how to avoid them. Use of staves, care of instruments, stadia reading, Curvature and refraction, Field book of rise and fall system, and collimation system, Checks, Bench marks, Datum, Level surface, Limit of errors.

O. S. 2. Surveying II :

Advanced study of the First Year Course

(a) *Levelling* :—Compound and continued series, Cross-section Levelling and contouring.

(b) *Theodolite Survey* :—Descriptions, Care of instruments, Method of traversing, Gales traverse-field-book, Plotting limit of error, How to apply correction, Laying out curves by chord and offset method and by theodolite. Use of sextant, Trigonometrical Survey.

Knowledge of all surveys in India from C. T. S. onwards, Useful problems.

O. S. 2A. Principles of Survey Instruments :

Instruments for linear measurements :—Pegs, flags ; offset rods ; tapes ; chain and arrows.

Instruments for determining directions :—Official square ; cross staff ; prismatic compassing ; surveying compasses ; compass attached to levels ; plane table—alidade and rectangular compasses ; theodolite ; sextants, mining dials.

Levels :—Abney levels ; Road tracer (Ceylon pattern) ; Road perambulator ; Surveying Aneroid Barometer ; Clinometer.

Instruments for office work :—Acre-comb : Planimeter ; Pentagraph ; Proportional compass ; Drawing and ferro-printing accessories.

O. S.
2nd Year ;
2 hrs.
a week ;
Lecture.

O. S.
2nd Year ;
2 hrs.
a week ;
Lecture.

O. S. 3. Surveying III :

Engineering Surveying :—Surveying requirements when taking a project for a building, bridge, road, canal and railway.

O. S.
3rd Year ;
3 hrs.
a week ;
Lecture.

Curves and alignments :—Setting out by theodolite and chain and by means of chord and offsets—Compound Curve, Diversion, Vertical, Spiral or Transition Curves—Area of Cross-Section.

Topographical Maps :—Approximate discharge of streams and rivers. Preliminary survey and final contour survey.

Astronomy :—The earth as an astronomical body. The celestial sphere, Apparent path of the Sun among the stars. Definitions—Astronomical system of Co-ordinates—Measurement of time—Relation between time and longitude—Correction to observation.

O. S. 4. Civil Engineering I :

Building materials :—Stone-selection, characteristics—classification and varieties—quarrying, blasting, dressing, implements.

O. S.
1st Year ;
4 hrs.
a week ;
Lecture.

Bricks and Tiles—classes and qualities, moulding, drying and stacking, burning, types of kilns—manufacture.

Lime, Cement, Mortar and Concrete—uses, varieties—plaster and whitewash.

Iron and Steel—uses, characteristics, painting.

Timber—growth—felling—classification and properties—suited for particular purposes—preservation.

Construction :—Stone masonry—dressing, bond, Ashlar and Rubble masonry, Racking buck, corbel, lintel, jamb, Reveal, Sill coping, Lewis, Dowel, Joggle, Cramp, Template. Precaution against moisture and settlement.

Brick Masonry :—Types and their uses, bond, closer, Racking back, Coping, cornice parapet—corbel, lintel, jamb, Reveal sill, drip course. Hollow masonry—Reinforce brick work—Precaution against moisture and settlement.

Types of doors and windows and their fittings—Damp proof courses.

O. S. 5. Civil Engineering II :

O. S.
2nd Year ;
4 hrs.
a week ;
Lecture.

Sites, Foundations—description of different types and calculations. Pile driving—Construction and sinking of masonry wells, walls, strutting, buttresses, pilasters, scaffolding, shoring, under pinning, plastering, pointing. Retaining walls—depth of foundation—counterforts and buttresses, Revetments. Simple masonry dams, Floors and roofs. Ceilings. Arches, columns, stanchions with details of design—staircases with details of design.

Culverts, beams, girders, and simple bridges.

R. C. Concrete Construction, Calculations with details of simple slabs, T. beams and columns.

O. S. 6. Civil Engineering III :

O. S.
3rd Year ;
4 hrs.
a week ;
Lecture.

Bridges—selection of site—Types—foundations—piers and abutments—Bricks—steel and concrete bridges—Pile and Pile driving.

Foundations—Safe pressure, columns—Cantiliver and grillage, well and pile foundations.

Roofs—Steel and timber—consideration of materials. Determination of stresses in various methods—Design of roof trusses, roof coverings, collar beam and beams.

Columns and Struts—Use of Euler's, Gordon's Rankings and Fidler's and Straight line formula—Bucking factor—Comparative strength. Choice of sizes of sections—Finish of steel work. Joints—and End bearings. Method of fixing and supporting ends specifications.

Fire proof constructions.

Reinforced concrete, elementary theory of construction—advantages and disadvantages. Theory and design—simple beams, T. beams, slabs, sheer—bend Location of reinforcement. Doubly reinforced beams—foundations—Columns. Simple Cantiliver and retaining walls.

O. S. 7. Highways and Irrigation :

O. S.
2nd Year ;
2 hrs.
a week ;
Lecture.

Roads—types—construction and maintenance, types of bridges and culverts.

Railways—Land required, earth work—Road crossings, Grades and Ruling gradients. Permanent way—Ballasting

materials used and function of permanent way. Maintenance Points and crossings—plate laying. Super elevation. Station Requirements, Tunnelling. Light and Mountain Railways.

Irrigation—Well irrigation—Canal irrigation—Method of raising water from wells—Channels—design of channels—critical velocity—spoil banks. High embankments—outlets, discharges.

Headwork—Description—Main weirs—foundations—function of dropping shutters—under sheices—System of lifting sluices—canal head regulators—works—regulators—falls and their design—Rapids, Bed bars, Silt tanks—escapes. Dead water—Method of influencing current.

O. S. 8. Estimates and Specification I :

Rules for taking off quantities in earth work, masonry, wood work, steel work, and plumber work. Rates and their analysis. Calculation of quantities of materials required for the completion of work. Contracts preparation and laws.

O. S. 9. Estimates and Specification II :

Advanced estimates
Agreement, Contracts
Accountancy.

O. S. 10. Sanitary Engineering :

Drainage—sewers and drains—separate and combined system. Sewage—disposal and purification—Systems—design and lay out—Advanced hydraulic machines.

House fittings :—Water closets, urinals, sinks, baths, house drain connections with sewers and drains. Materials used in construction, flushing—Calculation of sizes and gradients.

Water Supply :—Storage, reservoir, tanks (sources of water supply) : filtration, simple and mechanical filters ; sterilization and chlorination. Pumping arrangements.

O. S.
3rd Year ;
4 hrs.
a week ;
Lecture.

Distribution—Lay out of simple mains, water supply fittings—Calculation of hydraulic mean gradient and mean depth. Losses of head.

System of collection and removal of refuse. State of sanitation in India.

O. S. 11. Drawing I :

O. S.
1st Year ;
12 hrs.
a week ;
Practical.

Use of instruments—Lettering—Construction of Scales—Construction of curves. Geometrical drawings—Orthographic and isometric projections—sections—Developments. Simple working drawing of buildings. Bolts, nuts, and Rivetted joints. Details of doors and windows—Arches—Mouldings—Pillars—Details of roof trusses.

O. S. 12. Drawing II :

O. S.
2nd Year ;
12 hrs.
a week ;
Practical.

Building construction details. Design of Brick masonry buildings. Drawing of culverts, railway, road, structural building plans from measurement and specifications. Architectural Drawings.

* Fastenings — Pulleys — Gearings — Preparing drawing from sketches of simple machines such as Polishing lathe, Press-machine, Screw jack etc.

O. S. 13. Drawing and Design :

O. S.
3rd Year ;
12 hrs.
a week ;
Practical.

Design and Drawing of buildings—Culverts and simple bridges. Architectural drawings—sketching and drawing of machine parts.

O. S. 14. Office Work I :

O. S.
1st Year ;
6 hrs.
a week ;
Practical.

Preparing a chart of conventional signs, plotting from field book, From plan to prepare a field book and replotting. Reducing and enlarging maps by pentagraph and proportional divider, Tracing, Colouring and ferro-printing, How to keep drawings and records, Area calculation by acre-comb and tale square.

Preparing maps of practical survey work during the session.

O. S. 15. Office Work II :

Tracing, Colouring, Ferro-printing, Keeping records, Preparing survey plates, Preparing comparative maps and case maps, Partition of lands, Plotting by rectangular co-ordinates, Co-ordinates, Computing area, Preparation of charts. O. S. 2nd Year ; 6 hrs. a week ; Practical.

O. S. 16. Practical Survey I :

Chain, Compass, Plane-table, Levelling.

O. S. 17. Practical Survey II :

Levelling, Traversing with theodolite, Curve tracing, Trigonometrical survey. O. S. 1st Year ; 4-6 weeks ; Practical.

O. S. 18. Practical Survey III :

Road project : Curve Tracing : Astronomical observations and determination of Azimuth Problems. O. S. 2nd Year ; 4-6 weeks ; Practical.

O. S. P. 1. Elementary Physics :

General Measurement :—Fundamental units in C. G. S. and F. P. S. systems. Mass, density and specific gravity. Air pressure, Barometer, Centre of gravity. Boyle's law, Siphon, Pressure gauges and Water pumps. O. S. 3rd Year ; 4-6 weeks ; Practical.

Heat :—Thermometry—Expansion of Solids, liquids and gases—Charles' law, specific heat, Fusion, evaporation and boring. Latent heat. Radiation—conduction. Heat and Work. Calorific value of coal. O. S. 1st Year ; 4 hrs. a week ; Lectures.

Light :—Transmission of light. Illumination and photometry. Reflection and Refraction, mirror and lenses. Principles of the telescope.

Magnetism :—General properties of magnets. Magnetic Induction, magnetic lines of force. Terrestrial magnetism with reference to dip, variation.

Electricity :—Electricity, charge, potential, cells, electric current, E.M.F., Resistance, Ohm's law.

Sound :—Elementary knowledge only.

Physical Laboratory :

O. S.
1st Year ;
3 hrs.
a week ;
Practical.

1. Use of Scales, Dividers, Vernier Scale, Screw gauge.
2. Use of Balance.
3. Determination of Centre of gravity.
4. Determination of density of Solids.
(a) by Hydrostatic balance.
(b) by Specific gravity Bottle.
5. Reading of Barometer.
6. Determination of fixed points of thermometers.
7. Determination of specific heats of solids.
8. Verification of laws of reflection and refraction.
9. Photometry.
10. Measurement of Dip.

O. S. M. 1. Trigonometry and Mensuration :

O. S.
1st Year ;
4 hrs.
a week ;
Lectures.

Trigonometry—Theory of scales—natural scales, logarithmic scale, verniers. Trigonometrical ratios—measurement of angles, Logarithmic series, Cosines etc. Use of logarithmic tables, Solution of triangles. Problems of heights and distances.

Mensuration—Solution of triangles—area of plane figures field-book—surface and volume of solids and frustum of solids—Duodecimals.

O. S. E. M. 1. Applied Mechanics I

O. S.
1st Year ;
3 hrs.
a week ;
Lecture.

- (1) Fundamental units.
- (2) *Motion* :—Velocity and speed ; Linear velocity and acceleration ; Angular velocity, Circular motion ; Composition and Resolution of velocity ; Velocity considered as Vector ; Motion with uniform acceleration ; Motion under gravity ; Motion down a smooth inclined plane.
- (3) Force, Inertia, Momentum, Laws of Motion ; Measurement of Force ; Concurrent and Non-

concurrent Forces ; Parallel Forces ; Couples ; Composition and Resolution of Forces ; Forces as Vectors ; Equilibrium of Forces ; Centre of gravity ; Determination of Centre of gravity.

- (4) Work, Power, Energy.
- (5) Application of the foregoing in Levers, Pulleys and Balances.

O. S. E. M. 2. Applied Mechanics II :

O. S.
2nd Year ;
3 hrs.
a week ;
Lectures.

- (1) Graphical Statics ; Funicular Polygon ; Bending Moment and Shearing Force in Beams, Roof frames and Stress Diagrams.
- (2) Elasticity, stress, strain, Hooke's Law, Stress Strain Diagram, Elastic Limit, Ultimate stress, Working Stress, Factor of safety.
- (3) Bending Moment and Shearing Force Diagrams of Simple Beams and Cantilevers.
- (4) Moment of Inertia, Moment of Resistance, Section Modulus, Neutral Axis, Stiffness of Beams, Deflection Formula in Simple cases. Momentum—angular momentum, Rotational inertia.
- (5) Shafts—solid and hollow—torsion—springs—fly wheels and Governors—whirling of shafts.
- (6) Rivet joints in Frames and structures, columns and struts.
- (7) Transmission of motion by belts, ropes, chain and wheel.
- (8) Hydraulics—Hydraulic pressure and transmission—Flow through orifices, weirs and pipes—Losses. Simple hydraulic machines.

O. S. M. E. 1 : Elementary Mechanical Engineering :

Boilers—Common types and their description and uses—Erection and inspection—Arrangement and lagging—Steam Engines—description of the simple types—foundations and erection.

O. S.
3rd Year ;
3 hrs.
a week ;
Lecture.

Internal combustion engines—description of petrol, oil and gas engines—erection—running—location of faults.

Hydraulic machinery—Common type of reciprocating and centrifugal pumps—Turbines.

Power Transmission—by belts, gearing, screws, ropes, chain and friction drives.

Fastenings—Bolt & nuts, keys, cotters.

O. S. W. 1. Mechanical Laboratory :

Use of Instruments and Meters, such as Planimeters, Thermometers, Water-meters, Gas-meters, Pressure and vacuum gauges. Determination of calorific value of Fuels.

Location and correction of defects in steam, oil and gas engines. Running and management of Engines, Boilers, and Pumps.

Tensile test of Steel.

Bending test of Steel and Wood.

Compression test of Brick, Cement etc.

O. S. E. E. 1. Elementary Electrical Engineering :

Lightning conductor—parts used in and general rules for erection ; function of the lightning conductor, earth resistance and method of measuring it. Tests.

House wiring—Layout of simple D.C. distribution system—working of simple switch boards. Protection-devices and fault location in a small power station.

Street lighting—Cable laying.

Elementary Principles of working D.C. & A.C. machines.

Elementary Electricity, Ohm's Law—Volt, Ampere, Watts, Board of Trade Unit of Electric Energy.

O. S. E. E. 2. Electrical Engineering Laboratory :

1. To study different parts of a dynamo.
2. To study M.I. and M.C. type of Voltmeters and Ammeters.
3. To study Watt Low meter.

O. S.
3rd Year ;
3 hrs.
a week ;
Practical.

O. S.
3rd Year ;
3 hrs.
a week ;
Lecture.

O. S.
3rd Year ;
3 hrs.
a week ;
Practical.

4. Cable joints and soldering.

5. To sketch out switch-board connections, variation of speed of a shunt motor. To run a compound motor and to reverse the direction of rotation. To run a series motor with drum type controller.

6. To study the use of a meggar ; To test and locate fault in armature, field coils, and commutator.

7. Wiring calculation of size of cable and cost.

8. To charge storage battery.

AGRICULTURE

Agri. 1. Agricultural Botany :

Agri. 1st
Year ; 2 hrs.
a week ;
Lecture.
4 hrs.
a week ;
Practical.

General description of a plant, kind of plants—annual, biennial, perennial. Parts of a Plant—root, stem, leaf, flower, fruit. Germination ; essential of germination. The function of the parts of a plant—(1) seed, (2) root, (3) stem, (4) leaf, (5) flower, (6) fruit. Composition of plants—(1) water, (2) dry matter—combustible, incombustible or ash, essential ingredients, non-essential ingredients. Plant food—(a) Soil, air and rain ; water and sunshine, (b) how plants take food and develop, (c) most important elements of plant food, (d) Nitrification.

Agri. 2. Farm Crops I :

Agri. 1st
Year ; 2 hrs.
a week ;
Lecture,
16 hrs.
a week ;
Practical
($\frac{1}{2}$ year).

Vegetable Gardening—each student will be given a plot on which to grow vegetables. This practice is accompanied by lectures on varieties and principles of culture. Garden Crops of Bengal and their requirements will receive special attention.

Agri. 3. Farm Crops II :

Agri. 1st
Year ; 2 hrs.
a week ;
Lecture
(Second
 $\frac{1}{2}$ year).
2nd Year ;
2 hrs.
a week ;
Lecture.
10 hrs.
a week ;
Practical
(First
 $\frac{1}{2}$ year).

Field Crops and their productions—(a) choice of crops and variety as determined by climate, soil, seasons, special requirements of crops and market. Importance of leguminous crops, rotations, principles underlying rotation, fallows and mixtures.

(b) Production, selection and care of seed, steeping and fumigation. Sowing methods (i) by hand, (ii) by drill.

(c) Rotation—(i) advantages, (ii) reasons for, (iii) rules for, (iv) examples of.

(d) Improvement of crops by selection of seed and other methods.

(e) Weeds, fungus and insectpests and their preventions.

(f) Harvesting, Threshing, Winnowing, Storing and Marketing.

(g) Growing of particular crops—

A. Paddy (a) Aus, aman, boro ; (b) preparation of land ; (c) Seed and selection thereof ; (d)—(1) Sowing time, (2) quantity of seed to grow, (3) manure, (4) after cultivation, (5) harvesting, (6) yields.

B. Jute—yields ; Sugarcane—yields ; Wheat, Barley, Oats—yields ; Pulses and leguminous crops—yields ; Maize—yields ; Millets—yields ; Oil seeds—yields ; Fodder crops—yields.

Agri. 4. Animal Husbandry I :

(Types and breeds of farm animals)—Types of cows, horses, sheep, buffalo, goats and hogs. Feeds and feeding ; breeding and management of livestock, housing and care. Treatment of young animals and pregnant ones. Disposal of animal dung and other refuse. Cattle foods available in Bengal and their relative value. Forage crops and their production. Silos and ensilage. Treatment of diseases.

Agri. 1st
Year ; 2 hrs.
a week ;
Lecture
(First
 $\frac{1}{2}$ year).

Agri. 5. Animal Husbandry II :

Dairy Husbandry—Breeds of cattle, feeding, milking, handling of milk, making of butter, ghee, cheese, curd etc. ; milk testing, principles of a profitable dairy business.

Agri. 1st
Year ; 2 hrs.
a week ;
Lecture
(Second
 $\frac{1}{2}$ year).

Agri. 6. Animal Husbandry III :

Poultry Husbandry—Breeds, Indian and foreign ; their characteristics and advantages, housing, management and care. Feedings and handling of poultry, making of rations, natural and artificial incubation, use of incubators, testing of eggs.

Agri. 2nd
Year ; 2 hrs.
a week ;
Lecture
(First
 $\frac{1}{2}$ year).
6 hrs.
a week ;
Practical.

Agri. 7. Soils and Fertilisers :

Agri. 1st
Year ; 2 hrs.
a week ;
Lecture
(First
 $\frac{1}{2}$ year).

General description of soil and sub-soil. Formation of soils (a) weathering of the earth's crust, (b) action of changes of temperature, (c) action of vegetation, (d) action of water, (e) action of frost, (f) action of animal and insect life. Composition of soils, classification of soils (1) indigenous and transported soils ; (2) classification according to (a) composition, (b) texture, (c) moisture, (d) temperature, (e) fertility, (f) crops grown.

Brief and simple account of the soils of Bengal. Preparation and improvement of the soil—by tillage, plough, harrow, roller, spades, hoe. Eastern and Western implements, irrigation, drainage, manures and manuring.

Manures and Manuring—(a) classification of general and special manures ; natural and artificial manures, (b) Composition and values, (c) Great importance of conserving farm yard manure in India—pitting with urine and protecting from sun, (d) application, (e) Green manuring, (f) Line and lining.

Agri. 9. Farm Machinery :

Agri. 2nd
Year ; 2 hrs.
a week ;
Lecture.
(First
 $\frac{1}{2}$ year).

Study of farm machines adapted to Indian condition, principles, selection, construction, operation, care and repair of common tools and machines used on the farm. Sources of power on the farm ; principles of oil, and petrol engines and tractors ; selection, operation and care of engines, and practice in the handling of tools is given in the workshop.

Agri. 10. Horticulture and Floriculture :

Agri. 2nd
Year ; 2 hrs.
a week ;
Lecture.
4 hrs.
a week ;
Practical.
(First
 $\frac{1}{2}$ year).

Principles of propagation including budding, grafting, transplanting, pruning, insect and disease control ; harvesting and marketing ; methods of culture, study of the principal fruit trees with reference to their morphology, anatomy, physiology, varieties of diseases and cultivation. The principles and practice of artistic garden planning. The chief ornamental plants available in Bengal, their varieties and culture.

Agri. 11. Agricultural Zoology :

The anatomy of vertebrate animal is studied because of its bearings upon animal husbandry ; the characteristics and habits of rodents, birds and other animals injurious to crops ; a study of insects with special reference to those injurious or useful to the agriculturists ; the insects which carry disease ; the control of insects. Insects attacking stored products and their control. Identification of insect pests in the field by the nature of damage to crops. Recognition of insects of agricultural importance.

Agri. 2nd
Year ; 2 hrs.
a week ;
Lecture.
4 hrs.
a week ;
Practical.
(First
 $\frac{1}{2}$ year).

Agri. 12. Irrigation and Drainage :

Necessity of irrigation. Sources of water. Methods of raising water from wells, tanks, rivers, including hand power, bullock power, and power machinery and its distribution. Water requirements of crops. Advantages of different systems of irrigation. Relation of irrigation to drainage. Necessity, advantages and methods of drainage. Control of soil moisture.

Agri. 2nd
Year ; 2 hrs.
a week ;
Lecture.
(First
 $\frac{1}{2}$ year).

Agri. 13. Agricultural Economics :

Farm organisation and management—land and its equipment—fencing—roads—drainage—water supply. Standing Capital—Working or Floating Capital ; Cost of production ; Farm accounts.

Agri. 2nd
Year ; 2 hrs.
a week ;
Lecture.
(First
 $\frac{1}{2}$ year).

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