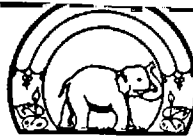
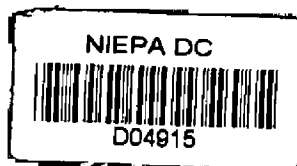


# Indian School Certificate Examination

**March 1991**

**REGULATIONS  
AND  
SYLLABUSES**



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**FOR REFERENCE ONLY**

**This booklet contains :**

**I REGULATIONS**

**Pages (1) to (15)**

**II SYLLABUSES**

**Pages 17 to 209**

**III LIST OF PRESCRIBED TEXTS**

**Pages 211 to 221**

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## THE COUNCIL

### Origin

1. The Council for the Indian School Certificate Examinations was established in 1958 by the University of Cambridge Local Examinations Syndicate with the assistance of the Inter-State Board for Anglo-Indian Education. It is registered under the Societies Registration Act No. XXI of 1860.

### Recognition

2. The Delhi Education Act, 1973, passed by Parliament, in Chapter 1 under *Definitions* Section 2(s), recognises the Council as a body conducting public examinations.

### Constituents

3. The Council has been so constituted to secure suitable representation of Governments responsible for schools (which are affiliated to it) in their States/Territories ; the Inter-State Board for Anglo-Indian Education ; the Association of Indian Universities ; the Association of Heads of Anglo-Indian Schools, the Indian Public Schools' Conference ; the Association of Schools for the I.S.C. Examination and eminent educationists.

### Administration

4. The Council is administered by an Executive Committee consisting of the Chairman and four members elected by the Council. The Secretary of the Council is ex-officio Secretary of the Committee.

5. The Secretary acts as Secretary to the Council under the authority of the Chairman. Subject to the overall control of the Council and the Executive Committee, the Secretary exercises all powers of the Council related to the administration of the examinations in accordance with the provisions of the Regulations and of other rules and procedures approved by the Council from time to time and for the time being in force.

### Examinations

6. The Council conducts the Indian Certificate of Secondary Education and the Indian School Certificate Examinations.

7. There is a Committee on Examinations and Subject Committees for drawing up and revising syllabuses and receiving criticisms and suggestions. The Council has its own teams of trained examiners, specialists and advisers.

## INDIAN SCHOOL CERTIFICATE EXAMINATION

### CHAPTER I

#### A. Introductory

1. The **Indian School Certificate Examination** has been designed as an examination, through the medium of English, in accordance with the recommendations of the Kothari Education Commission after a two-year course of studies beyond the *Indian Certificate of Secondary Education* (Year-10) examination or its equivalent.

2. Private candidates are not permitted to appear for the examination.

#### B. Conditions of eligibility for admission to Class XI

1. (a) Candidates who have been awarded Pass Certificates in the Indian Certificate of Secondary Education Examination with passes in five subjects including English and a second language are *eligible* to be admitted for preparation in courses of study leading to the Indian School Certificate examination.

(b) Candidates who have been awarded Pass Certificates in the Indian Certificate of Secondary Education examination with passes in five subjects including English, but *without* a pass in the second language, may be admitted *provisionally* to the first year of the course and will be required to pass in the second language of the Indian Certificate of Secondary Education examination at the end of Class XI before being declared *eligible* for promotion to Class XII in preparation for the Indian School Certificate (Year-12) examination.

2. (a) The eligibility of candidates who have been awarded Pass Certificates in an *equivalent* examination conducted by another Examining Board will be decided by the Secretary of the Council. The conditions for eligibility are as follows :

(i) The candidate must have been awarded a Pass Certificate in accordance with the requirements of the Board at an equivalent examination taken at one and the same sitting, and

(ii) the candidate must have obtained pass marks, in accordance with the regulations of the Board, in English and a Second Language.

(b) Heads of Schools may admit *provisionally* in Class XI a candidate who has been thus awarded a Pass Certificate by another

Examining Board. They must submit to the Council immediately on granting provisional admission certified true copies of the Statement of Marks issued to the candidate by the Examining Board. If the candidate is eligible the Council will issue an Eligibility Certificate to the Head of the School concerned in respect of the candidate.

(c) Heads of Schools may also admit *provisionally* a candidate who has been awarded a Pass Certificate in an equivalent examination conducted by another Board with pass marks in English but without a pass in a Second Language. Such candidate however, will be required to *pass* in the Second Language of the Indian Certificate of Secondary Education Examination at the end of Class XI before being declared *eligible for promotion* to Class XII in preparation for the Indian School Certificate (Year-12) examination. In this case the Eligibility Certificate will be issued *after* the candidate has been declared to have passed in the Second Language.

### C. Conditions of Entry

1. Entry to the Indian School Certificate examination in the case of eligible candidates who are being entered for the first time is restricted to candidates with a minimum of 75% attendance of the working days during each year of the two-year course at school(s) affiliated to the Council and registered for the Indian School Certificate Examination.

Candidates may be entered only by the school they are attending and, in this respect, the decision of the Head of the school is final.

2. Candidates who were entered as school candidates in accordance with(1) above, and who were not awarded *Pass Certificates* may be entered again by a school on the school entry form, provided that such candidates are in attendance at an affiliated and registered school in the year of the examination.

Candidates can be entered only by the school they are attending and, in this respect, the decision of the Head of the school is final.

3. Candidates entered as school candidates in accordance with (1) or (2) above and who are not awarded *Pass Certificates* will be permitted to re-appear for the examination once only in the year following their failure, but not thereafter, without further attendance at an affiliated and registered school.



## REGULATIONS OF THE INDIAN SCHOOL CERTIFICATE EXAMINATION

They must apply on the special form provided for the purpose, which will be obtainable from the Council's office, through the Principals of schools from which the candidates appeared for the examination in the previous year and failed.

4. Candidates who have been awarded Pass Certificates will be permitted to enter for a *Supplementary Pass Certificate* without further attendance at an affiliated and registered School. They must apply on the special form provided for the purpose which will be obtainable from the Council's office through the Principals of Schools from which the candidates appeared originally for the examination.

5. There is no age limit for candidates taking the examination.

### D. Minimum Attendance Requirement

Candidates whose attendance is below 75% of the working days are ordinarily *not* eligible to sit for the examination. However, the Secretary has authority to condone the shortage in the case of candidates whose minimum attendance is not less than 60% of the working days. Heads of Schools may represent to the Secretary cases of candidates who deserve special consideration for condonation, provided that the attendance of such candidates is not less than 60% of the working days.

### E. Withdrawal of Candidates

Candidates may be withdrawn at any time previous to the commencement of the examination :

Provided that, once the entries have been **acknowledged as accepted by the Council's office**, Heads of Schools may only withdraw candidates :

- (a) *on account of illness of the candidates certified by a registered medical practitioner ; or*
- (b) *at the express written request of the parents/legal guardians of the candidates.*

Applications for withdrawals will have to be submitted on the special form to be supplied by the Council's office.

Refund of fees in the case of candidates duly withdrawn will be made in accordance with the conditions laid down under the heading 'Refunds' on page 13 of these Regulations.

### F. Syllabuses

The syllabuses of the Indian School Certificate (Year-12) Examination are **included in this booklet and are obtainable from the Council's office or from booksellers to be notified by the Secretary of the Council.**

### G. Disqualification

If any of the regulations made for the conduct of the examination is disobeyed, the candidate or candidates concerned may be disqualified.

## CHAPTER II

**IMPORTANT NOTE :** The responsibility for the correct selection of subjects to meet university or professional requirements of a candidate or candidates will be that of the school.

### A. Subjects of Examination

#### Part I— External Examination

*Compulsory Subject* 1. English

*Elective Subjects*

- |                                    |   |
|------------------------------------|---|
| 2. An Indian Language              | 15. Physics   |
| or                                 | 16. Chemistry   |
| A Foreign Language                 | 17. Biology   |
| 3. A Classical Language            | 18. Home Economics  |
| 4. Literature in English           | 19. Needlework and Dressmaking                                      |
| 5. History                         | 20. Electricity and Electronics                                     |
| 6. Structure of Modern Governments | 21. Engineering Science<br>( <i>May not be taken with Physics</i> ) |
| 7. Geography                       | 22. Computer Science  |
| 8. Sociology                       | 23. Geometrical and Mechanical Drawing                              |
| 9. Psychology                      | 24. Geometrical and Building Drawing                                |
| 10. Economics                      | 25. Art   |
| 11. Structure of Commerce          | 26. Music (Indian or Western)                                       |
| 12. Principles of Accounts         | 27. Physical Education  |
| 13. Office Practice                |   |
| 14. Mathematics                    |   |

#### Part: II—Internal Examination

Socially Useful Productive Work and Community Service (Compulsory).

Exemption from the Socially Useful Productive Work and Community Service requirement *may* be made, in special cases, by the Secretary of the Council.

### B. Choice of Subjects

All candidates for the Pass Certificate must enter and sit for **English** (compulsory) with **three, four or five** elective subjects and must have been evaluated internally by the School in Socially Useful Productive Work and Community Service (compulsory).

**Note:** 1. A candidate may not enter for more than six subjects including the compulsory subject English.

## REGULATIONS OF THE INDIAN SCHOOL CERTIFICATE EXAMINATION

2. A School may not enter candidates for subjects for the teaching of which no provision is made by the School.

3. **The responsibility for the correct selection of subjects to meet university or professional requirements of a candidate or candidates will be that of the school.**

### C. Awards and conditions for awards

1. **PASS CERTIFICATES** will be awarded to candidates who at one and the same examination attain the pass standard in *four or more* subjects which must include the subject English :

Provided that no candidate except as otherwise exempted by the Council, shall be awarded a Pass Certificate unless in addition to fulfilling the conditions above he has attained a pass grade in SUPW and Community Service as examined/assessed internally by the School.

2. **SUPPLEMENTARY PASS CERTIFICATES** will be awarded to candidates who have obtained **PASS CERTIFICATES** and who appear in a subsequent examination and reach the *pass* standard in *one or more* subjects.

3. **STATEMENTS OF MARKS** will be issued to all candidates who are awarded Pass Certificates/Supplementary Pass Certificates.

**The Pass mark for each subject is 40%.**

### D. Issue of Results :

All results will be issued through the Heads of Schools to whom results will be sent as soon as possible after the award has been completed. The result sheets show the result in the examination as a whole and also indicate the standard reached in each subject taken, except Socially Useful Productive Work and Community Service, by grades from 1 to 9, 1 being the highest and 9 the lowest. 1, 2, 3, 4, 5 or 6 indicates a *Pass with credit*, 7 or 8 indicates a *pass* and 9 a *failure*. Very good is indicated by 1 or 2.

The standard reached in Socially Useful Productive Work and Community Service (internally assessed) will be shown on the result sheets by grades A, B, C, D or E ; A being the highest and E the lowest. A, B, C or D indicates a *pass* and E a *failure*.

### E. Certificates etc.

1. *Pass Certificates/Supplementary Pass Certificates* will be issued through the Heads of schools as soon as possible after the issue of results.

## REGULATIONS OF THE INDIAN SCHOOL CERTIFICATE EXAMINATION

2. Duplicates of *Pass Certificates* / *Supplementary Pass Certificates* are not issued.

3. Duplicates of *Statements of Marks* will be issued on application accompanied by a certificate countersigned by the Head of School concerned stating that the original Statement of Marks has been actually lost, and on payment of the prescribed fee.

4. *Migration Certificates* will be issued at the request of Heads of Schools concerned to candidates who have been awarded Pass Certificates on payment of the prescribed fee.

### F. Ownership of answer scripts and other materials.

All written replies (answer scripts) and any other work done by candidates during the examination and the copyright therein are the property of the Council and will not be returned and every application to enter for the examination, (whether through a school or by an individual candidate) will be deemed to constitute an agreement by each candidate entered for the examination with the Council to assign such copyright to the Council.

### G. Evaluation of answer scripts

1. The evaluation of answer scripts and of other work done by candidates during the examination is within the domestic jurisdiction of the Council and, therefore, no outside person or authority has jurisdiction to check/scrutinise the answer scripts or other work done by candidates.

2. The marking of answer scripts and of other work done by candidates during the examination by the Council or its examiners and the results of such marking shall be final and legally binding on all candidates and the **Secretary of the Council** will not, except in his absolute discretion, enter into correspondence about results with candidates or their parents or guardians or other persons claiming to act in *loco parentis*.

### H. Enquiries concerning examination results

1. All enquiries concerning examination results on behalf of school candidates must be made to the **Secretary of the Council** by the **Principal of the School** concerned and must reach the **Council's office**, not later than the specified date. Schools are asked to bear in mind that a large number of answer scripts are re-marked by Chief

Examiners before the award.

Enquiries should be restricted to results which are *significantly* below the standard suggested by the candidate's school work in the subject.

2. The accuracy of a *subject grade awarded* will be checked on request, in *one subject per candidate* only, provided that the Principal of the School has good reason to believe that a mistake may have been made. Such applications must be made in the proforma (See Appendix) prescribed by the Council and must be received in the **Council's office** *not* later than one month after the receipt of the results by the schools. Schools will be required to pay a fee for each recheck.

**The recheck will be restricted to checking whether all the answers have been marked, and that there has been no mistake in the totalling of marks for each question in the subject and transferring marks correctly on the first cover page of the answer book, and whether the continuation sheets attached to the answer book mentioned by the candidate are intact. No other re-evaluation of the answer script or other work done by the candidate as part of the examination will be carried out.**

**No candidate shall claim or be entitled to re-evaluation or disclosure or inspection of the answer scripts or other documents as these are treated as most confidential by the Council.**

3. If the Principal of a School considers that the results in one subject are *significantly* below reasonable expectation, the **Secretary of the Council** is prepared to ask the examiners for notes on the main weaknesses shown by the work of a few selected candidates. It is necessary to limit such notes to *one subject per school* on any one occasion of examination and to restrict the enquiry to the work of *not more than six* candidates whose work is *significantly* below the standard as suggested by the candidate's school work in the subject. Applications for marking special notes must be received in the **Council's office** *not* later than one month after the receipt of the results by the school. A fee commensurate with the work involved will have to be paid to the Council.

#### **I. Re-examination**

The **Secretary of the Council** shall have the power to hold a re-examination or an additional examination, if he is satisfied that such a re-examination or additional examination is necessary.

**J. Last date for retaining answer scripts**

The Council does not undertake to retain answer scripts of candidates later than 60 days after the date on which the results are issued.

For *Enquiries concerning examination results* attention is invited to paragraph H above.

CHAPTER III

**A. Awarding Committee**

There will be an Awarding Committee consisting of *two* Heads of schools, one of whom will be a member of the Council, and the Secretary of the Council who will act as convener. The functions and powers of the Awarding Committee will be :

(i) to consider all cases of unfair means reported to the Secretary of the Council by the supervising examiners of the examination centres or by examiners during the marking of scripts or by any other source and ;

(ii) to take decisions on such cases in accordance with the provisions of the Regulations of the examination and following the procedures approved by the Council.

**B. Use of unfair means**

1. If the Awarding Committee is satisfied that a candidate has made previous arrangements to obtain unfair help in connection with the question papers from any person connected with the examination centre or any agency within or outside the examination centre, the candidate is liable to have his results in the examination as a whole cancelled.

2. (i) Candidates who are detected in giving or obtaining, or attempting to give or obtain, unfair assistance, or who are otherwise detected in any dishonesty whatsoever will be reported to the **Secretary of the Council** and may be expelled from the examination room forthwith and refused admission to subsequent papers.

(ii) The Supervising Examiner or any member of the supervisory staff shall seize the answer scripts in which the use of unfair assistance is suspected.

(iii) The Supervising Examiner shall send the seized answer scripts with a report giving the details of the evidence and the

## REGULATIONS OF THE INDIAN SCHOOL CERTIFICATE EXAMINATION

explanation of the candidates concerned to the **Secretary of the Council** without delay and, if possible, on the day of the occurrence.

(iv) In case the candidates concerned refuse to give explanatory statements they should not be forced to do so, only the fact of refusal shall be recorded by the Supervising Examiner and attested by two members of the supervisory staff on duty at the time of the occurrence.

(v) The Supervising Examiner has discretion to permit such candidates to answer the remaining part of the question papers but on answer sheets separate from those in which the use of unfair means is suspected.

3. Candidates found guilty of :

- (i) bringing in answer sheets ; or
- (ii) taking out or attempting to take out answer sheet ; or
- (iii) unlawfully substituting answer scripts or getting answer scripts replaced during or after the examination with or without the help of any person connected with the examination centre, or of any agency within or outside the examination centre

shall be reported to the **Secretary of the Council** and their results in the examination as a whole will be cancelled.

4. If it is subsequently discovered and the **Awarding Committee** is satisfied that candidates have either copied from other candidates or given opportunity to other candidates to copy from them or communicated dishonestly with other candidates, their results in the paper or subject or subjects in question or their results in the examination as a whole will be cancelled.

5. A candidate detected in approaching directly or indirectly an examiner or any member of the staff of the Council with the object of influencing him regarding the candidate's examination result shall have his result in the examination as a whole cancelled.

6. Candidates guilty of disorderly conduct or causing disturbance in or near the examination room are liable to be expelled from the examination hall forthwith and will be refused admission for subsequent papers.

7. (i) Candidates are not permitted to have in their possession, while in the examination room, any book, memorandum or pocket

## REGULATIONS OF THE INDIAN SCHOOL CERTIFICATE EXAMINATION

book, notes, or paper whatsoever, except the correct question paper. Candidates using slide rules as permitted by the regulations must see that any information (formulae or other data) shown on them is securely covered. They must return any incorrect question paper to the Supervisor immediately.

(ii) Candidates disregarding this caution are liable to have their results in the examination as a whole cancelled.

8. (i) Persons obtaining admission to the examination on false representation shall be expelled from the examination hall forthwith and will be reported to the Police.

(ii) Candidates who are impersonated shall be reported to the **Secretary of the Council** and their results in the examination as a whole will be cancelled.

9. (i) The decision in respect of the results of candidates who are suspected of using unfair means may be delayed considerably and will not be issued with the results of other candidates.

(ii) Candidates whose results in the examination as a whole have been cancelled may be debarred from entry to any subsequent examination.

10. A person who commits an offence under these regulations but is not a candidate, shall be dealt with as under :

(i) The Secretary to the Council may, if he so decides, hand the case to the Police.

(ii) In the case of a teacher or a person connected with an institution, his conduct shall be reported to the Governing (or Managing) Body of the institution.

11. Entries may not be accepted from a school where any member of the staff has at any time committed any offence under these regulations.

12. If the **Awarding Committee** is satisfied that the use of dishonest means in a paper or papers has been widespread at a centre, the **Awarding Committee** reserves the right to cancel the results of all candidates of that centre in the paper or papers concerned, or in the entire examination at the centre if several papers are involved.

13. For cases of unfair means not covered by these regulations, the **Awarding Committee** may enforce penalties according to the nature of the offence.



**14. Provided that no penalty under these regulations shall be imposed except after—**

- (i) giving the candidate an opportunity of making such representation in writing as he may wish to make in that behalf ; and
- (ii) taking the representation, if any, submitted by the candidate within the period allowed to him, into consideration.

**C. Power to alter, cancel results, certificates etc.**

1. The **Secretary of the Council** shall have the power to alter or cancel the results of a candidate after it has been declared, if

- (i) the candidate is found guilty of having used unfair means ;  
or

- (ii) a mistake is found in his result.

2. The **Secretary of the Council** shall have the power to cancel a *Pass Certificate*/*Supplementary Pass Certificate* which has been defaced or altered in any detail without the authority of the Council or which has been obtained by impersonation or by false representation of facts or by fraudulent or dishonest means of any kind.

## CHAPTER IV

**A. General Arrangements**

**1. Date of examination :** The printed time-table will be made available to all schools well before the examination.

**2. Centres of examination :** Centres for each town or area will be arranged by Heads of Schools concerned in consultation with the Council.

**3. Forms of entry :** Entry forms will be supplied to schools in **June/July** on application.

The forms and fees must be returned to the Council, New Delhi, **by the specified date.** *Late entries will not be accepted.*

**4. Transfers :** The *transfer* of a candidate from a centre in one town to a centre in another town will be allowed only within the same examination and for reasons accepted as adequate and on payment of a special fee. An additional charge may be made if it is necessary to send copies of question papers by air to the centre of transfer. Applications, naming the town to which a transfer is desired, should reach the Council's **office** two months before the commencement of the examination.

## REGULATIONS OF THE INDIAN SCHOOL CERTIFICATE EXAMINATION

**5. Name :** *Great care must be taken to ensure that the name of each candidate is entered in exactly the same way as it was entered in the ICSE or equivalent Certificate. No subsequent change in the name of the candidate will be permitted.*

**6. Entries for less than a certificate :** Candidates who have obtained *Pass Certificates of the Indian School Certificate* may subsequently enter for one or more subjects. A candidate who reaches the pass standard in the subject/subjects offered will receive a *Supplementary Pass Certificate*.

**7. Examination fees.\*** **The scale of fees will be notified separately.** Cheques/Bank Drafts should be made payable to the *Council for the Indian School Certificate Examinations, New Delhi*. Payment should be sent at the same time as the forms of entry.

Arrangements for Practical examinations and visits of examiners are made by the Heads of Schools, with the approval of the Council. No fees are payable to the Council for these, but there may be a special local fee to cover the cost.

### **8. Refunds**

(a) Refunds may be made in respect of candidates who may be withdrawn from the examination *provided* that the Head of the School notifies the Council not later than the specified date. The Council does not undertake to arrange for refunds to be made in cases where notification is received later than that date. No refund can be made for a candidate who has taken any part of the examination.

(b) The refund will amount to *half* the amount of the *subject fee* already paid.

(c) *Refunds will ordinarily be made in the month following the declaration of results.*

**9. Infectious diseases :** Candidates who have been exposed to any infectious disorder cannot be examined at a centre unless they are out of quarantine :

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\*The Council reserves the right to increase the fees should this prove necessary.

## REGULATIONS OF THE INDIAN SCHOOL CERTIFICATE EXAMINATION

Provided that a candidate suffering from an infectious disease if declared medically fit to sit for the examination may be permitted to appear for the examination after proper arrangements are made for his/her isolation and separate supervision. The scripts should be packed in separate envelopes and the school should seek the advice of the Medical Officer incharge in regard to the fumigation of the scripts before their despatch to the Council.

**10. Time allowance for question papers :** Any time specially allocated for reading through question papers or studying maps will be stated on the question papers.

**11. Materials to be provided by candidates :** Candidates must provide pencils, rubber, mathematical and dissecting instruments and painting materials. They are required to write their answers with *pens and blank ink* ; fountain pens and ball-point pens may be used, but pencils may be used only for diagrams. The use of slide rules is permitted in science subjects, but candidates using them should state this on their scripts and should be warned of the possible loss of accuracy involved. *Information such as formulae or other data which appears on slide rules must be securely covered before they are taken into the examination room.* Mathematical tables will be provided ; candidates are not allowed to take mathematical tables into the examination room. **The use of electronic, hand, desk or other types of calculator is not permitted.**

**12. School estimates :** Principals of schools may submit school estimates on a special form available from the Council's office for any candidate for whom special consideration is asked because of illness or other difficulty experienced *during* the examination.

**13. Statement of result :** *A fee is payable to the Council for the issue of a certifying statement of an examination result ; this fee should be forwarded with the application. The statement will normally be sent to the authority to whom it has to be produced.*

**14. Text-books :** *No special editions of books are prescribed except those which are mentioned specifically ; the Council cannot undertake to recommend text-books.*

**15. Standard in Subjects :** *In every subject, unless otherwise stated, standards will be assessed on the performance in the different papers in the subjects.*

**16. Clarity and neatness :** *Attention is called to the fact that the ability of candidates to express themselves clearly and to present their answers neatly and accurately is taken into account in assessing their work in all subjects.*

**B. Special Papers and Alternative Syllabuses**

The Council is prepared to consider requests for special papers :  
(i) in a subject for which no provision is made in these regulations.  
(ii) on a syllabus different from that prescribed in one of the subjects of the examination. Such papers and syllabuses must be of an equal standard with those to which they are proposed as alternatives.

A fee to cover the extra cost involved will normally be payable for each paper especially made for a small number of candidates. Applications should be made to the Council *at least two years* before the examination is to take place.

**C. Equivalence and Recognition**

Will be notified separately.

**APPENDIX**

*Proforma for a Principal to apply for a recheck of  
subject grade*

I have good reason to believe that a mistake may  
have been made in the result of candidate.....

Index No..... in subject.....

In accordance with the regulations, Chapter II H.  
(2) Pge 8, I hereby apply for a recheck to be made on  
the accuracy of the subject grade awarded to candidate

..... Index No.....

in subject .....

The results of the recheck may be communicated to  
me in due course.

The fee of Rs. . . . for this recheck is enclosed here-  
with.

*Signature of Principal*



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## COMPULSORY SUBJECT ENGLISH (801)

### English Language

#### Aims :

- (1) To develop habits of :
  - (a) clear articulate expression, using accepted syntactical forms and structures, with a firm grasp of idiom ;
  - (b) critical thinking, involving assessment and analysis of written material provided.
- (2) To acquire the capacity to examine and to assess the value, *as thinking*, of passages of argumentative writing, to consider the assumptions upon which the arguments rest and to trace the implications that follow.
- (3) To comprehend and appreciate good prose.
- (4) To develop an adequate and appropriate vocabulary.

There will be *two* papers as follows :

#### Paper 1 : (3 hours)

- Question One*     A composition on one of a number of subjects.
- Question Two*     A composition based on a situation described in detail.
- Question Three*   Short-answer questions to test grammar, structure and usage.
- Question Four*    Comprehension.

It is recommended that in Paper 1 about 50 minutes should be spent on Question One, 40 minutes on Question Two, 30 minutes on Question Three and 1 hour on Question Four.

#### *Question One*

Candidates will be required to select *one* composition topic from a choice of five. The choice will normally include narrative, descriptive and discussion topics.



## *Compulsory Subject*

The main criteria by which the compositions will be marked are as follows :

(a) The quality of the language employed ; the range and appropriateness of vocabulary and sentence structure ; the correctness of grammatical constructions, punctuation and spelling.

(b) The degree to which candidates have been successful in organising both the composition as a whole and the individual paragraphs.

### *Question Two*

Candidates will be required to write a composition based on the information and ideas provided. A situation and the purpose of the composition will be specified. Skills such as selection, amplification, condensing, re-arrangement and re-statement may be involved. The candidates' ability in the above skills will be taken into account and above all their ability to handle the language appropriately in the context of the given situation.

It is emphasised that only *one* question will be set in the examination paper and that this will be compulsory.

### *Question Three*

All the items in this question are compulsory, and their number may vary from year to year. They will consist of short-answer, open-completion items or any other type, which would test the same areas of ability in English language. Only two or three types will be included in any one examination.

### *Question Four*

For this question a passage of prose of about 500 words will be provided. Questions based on this passage will be set to test the candidates' ability to understand the content and argument of, and to infer information and meanings from, the given text. Questions to test the ability to summarise will be included. There will be no alternative questions. All questions will have to be answered.

**Part 2 : PRESCRIBED TEXTS (3 hours)**

**5 :**

- (a) To develop an appreciation of literature through the critical study of selected literary works.
- (b) To help students through the study of literature to an understanding of the study of man.
- (c) To create an interest in the warp of thought which differs from that of the group to which the student belongs.
- (d) To develop the power of expression.

*Candidates will be required to answer five questions as follows :*

**One:** *textual question (compulsory) on the Shakespeare play* **other with four other questions on at least three texts which may include the Shakespeare play.**

The textual question, which will be set on the Shakespeare text contain **four** short passages and candidates will be required to answer questions set on **three** of the passages. These questions may require candidates to explain words and phrases, to rewrite passages in modern English, or to relate an extract to the work as a whole.

The other questions on the Shakespeare play and on the other prescribed texts will require essay-type answers and will be set on the text, plot or plots, characters and other prominent literary qualities of the works prescribed.

**For Prescribed text books see Appendix.**

**ELECTIVE SUBJECTS**  
**INDIAN LANGUAGES (802—820)**

**Aims :**

- (a) To develop habits of clear, articulate expression using accepted syntactical forms and structures, with a firm grasp of idiom; and to comprehend and appreciate good prose.
- (b) To expose candidates to a deep knowledge and appreciation of literary works in the language.

There will be *two* papers as follows :

**Paper 1 : (3 hours)**

**Question 1. Composition :** One composition in the language to be written out of a choice of *five* topics set.

**Question 2. Comprehension :** An unseen passage of about 300 words will be set for comprehension with questions based on the passage. Some of the questions will test the ability to summarise.

**Question 3. Translation :** An unseen passage in English will be set for translation into the language.

**Question 4. Practical Tests in vocabulary, syntax and idiom, e.g. exercises in sentence construction, formation of sentences in the language correctly embodying given words or forms.**

**Paper 2 : PRESCRIBED TEXTS (3 hours)**

Candidates will be required to answer *five* questions on at least *three* of the prescribed text books.

For prescribed textbooks see Appendix.

## A MODERN FOREIGN LANGUAGE

Papers on the following Modern Foreign Languages will be set on application.

- |                   |                   |
|-------------------|-------------------|
| (a) French (821)  | (d) Chinese (824) |
| (b) Spanish (822) | (e) Tibetan (825) |
| (c) German (823)  |                   |

The examination will consist of *two* papers as follows :

**Paper 1** (3 hours) will consist of :

- (i) A short composition in the language.  
A choice of subjects will be given.
- (ii) An unseen passage in the language for translation into English.
- (iii) An unseen passage in the language with questions based upon it. Candidates may be required to make a summary in the language of the whole or part of the passage and to answer other questions of the following types : explanation of individual words or phrases or sentences ; questions to test comprehension. Questions of all these types will not necessarily be set at any one examination.
- (iv) Tests in vocabulary, syntax and idiom, e.g. synthesis, exercises in sentence construction, formation of sentences in the language correctly embodying given words or forms (some or all these may be set in connection with the passage in (iii) ).

**Paper 2** (3 hours) will consist of :

- (i) A passage in English for idiomatic translation into the language.

### *Elective Subjects*

- (ii) Questions on the prescribed text books. Candidates will be required to answer *four* questions on *two* prescribed text books.

**For prescribed textbooks see Appendix.**

*Note :* If suitable texts are not available Paper 2 will contain passages for translation from the language into English and passage for translation from English into the language.

## CLASSICAL LANGUAGES

Papers in the following Classical Languages will be set on application from schools providing teaching in the subjects.

### Sanskrit (836), Persian (837)

Two papers of *two and a half hours* each will be set which will include the following :

#### Paper 1 ( $2\frac{1}{2}$ hours)

- (a) Translation from the prescribed books. A choice of passages will **not** be given. Candidates will be required to translate from each of the prescribed books.
- (b) Questions, requiring short answers, to test knowledge of the subject-matter of the prescribed books.

#### Paper 2 ( $2\frac{1}{2}$ hours)

- (a) Questions on grammar.
- (b) Unseen translation from English into the language concerned, consisting of short prose sentences *and* a continuous passage of prose.
- (c) Unseen translation from the language concerned into English.

(List of prescribed texts may be had on application from schools preparing candidates.)

### ARABIC (838)

Two papers of *two and a half hours* each will be set which will include the following :

#### Paper 1 ( $2\frac{1}{2}$ hours)

- (a) Translation from the prescribed books\*. A choice of passages will **not** be given. Candidates will be required to translate from each of the prescribed books.
- (b) Questions, requiring short answers, to test knowledge of the subject-matter of the prescribed books\*.
- (c) Composition, which will consist of reproduction of descriptive/narrative passages from the text into simple Arabic.

\*Prescribed books will include about 150 pages of Selections of Prose and Poetry from classical as well as modern Arabic Literature.

## ***Elective Subjects***

### **Paper 2 (2½ hours)**

- (a) Questions on grammar which will include the following :
- (i) Articles
  - (ii) Suffixed Pronouns
  - (iii) Relative Pronouns
  - (iv) Sifat wa Mausuf
  - (v) Mudaf wa Mudaf Ilaihi
  - (vi) Nominal Sentence
  - (vii) Cases of the Noun
  - (viii) Declineables and Undeclineables
  - (ix) Verbs—simple forms
- (b) Unseen translation from English into Arabic consisting of short prose sentences and a continuous passage of prose.
- (c) Unseen translation from Arabic into English.

## LITERATURE IN ENGLISH (850)

### Aims :

- (a) To provide candidates with a wider course in Literature in English than that offered in the English paper.
- (b) To expose candidates to a deeper knowledge and appreciation of literary works in English.

There will be *two* papers of *three hours* each.

### Paper 1 : (3 hours)

Five textbooks will be prescribed.

*Candidates will be required to answer five questions on a minimum of three of the prescribed textbooks.*

**For Prescribed textbooks see Appendix.**

### Paper 2 : (3 hours)

Five textbooks will be prescribed.

*Candidates will be required to answer five questions on a minimum of three of the prescribed textbooks.*

**For prescribed textbooks see Appendix.**



## HISTORY (851)

### **Aims :**

The following aims are given to help teachers in determining their approach to the teaching of the prescribed courses and in understanding the qualities the examiners expect in the answers of candidates.

#### **1. Knowledge :**

Accurate knowledge of the most significant events and personalities of the period under study, in sequence and in context. Candidates should be familiar with the factual evidence upon which explanations or judgements about the period must be founded.

#### **2. Comprehension and Interpretation :**

- (a) The development of an understanding of the existence of problems and the relevance of evidence of explanations.
- (b) The development of the capacity to marshal facts and evaluate evidence and to discuss issues from a historical point of view.
- (c) The development of the capacity to read just historical views in the light of the new evidence or new interpretation of evidence.
- (d) The development of sense of historical continuity.
- (e) The diminution of ethnocentric prejudices and the development of a more international approach to world history.

#### **3. Expression of ideas :**

The ability to express views and arguments clearly using correctly the terminology of the subject.

#### **4. Knowledge of the historian's craft :**

Some acquaintance with various types of historical evidence and some awareness of the problems involved in evaluating different kinds of source material.

There will be **two** papers of **three** hours each as follows :

**Paper 1** (Modern Indian History) 3 hours.

The paper will be divided into *two* sections ; SECTION A and SECTION B corresponding to the division in the syllabus. Section A will contain SIX questions and Section B SEVEN question. Candidates will be required to answer *five* questions, THREE from Section A and TWO from Section B.

**Paper 2** : Modern World History 3 hours.

The paper will be divided into *two* sections ; SECTION A and SECTION B corresponding to the division in the syllabus. Section A will contain SIX questions and Section B SEVEN question. Candidates will be required to answer FIVE questions in all, THREE from Section A and TWO from Section B.

## PAPER 1

### MODERN INDIAN HISTORY

#### SECTION A

#### (The Freedom Struggle)

1. **The Dawn and rise of Indian Nationalism (1885-1905).**
  - (i) Factors promoting the rise of Indian Nationalism.
  - (ii) Beginning of Political agitation. Predecessors of the Indian National Congress in Bengal, Bombay, Madras Presidencies. Contribution of Surendra Nath Banerjee, Dadabhai Naoroji, Justice Ranade.
  - (iii) The foundation of the Indian National Congress; official attitude towards the Congress.
  - (iv) The programme and achievements of the early Nationalists (Moderates).
2. **The growth of Militant Nationalism (1905-1919)**
  - (i) Causes for the rise of Militant Nationalism.
  - (ii) The objectives and programme of the militants; contribution of Bal Gangadhar Tilak, Surendra Pal, and Lala Lajpat Rai.

## *Elective Subjects*

- (iii) Impact of Curzon's policies : Swadeshi and boycott movement; rise of militancy and revolutionary terrorism, split in Congress (1907)—government measures to win over the moderates—introduction of separate electorates and its impact on the National Movement.
- (iv) Impact of 1st World War on the National Movement.

### **3. Muslim Politics (1885-1919).**

- (i) Factors contributing to the rise of communalism (1905-1914).
- (ii) The role of Sir Sayyid Ahmad Khan and the Aligarh school in Muslim Politics; the contribution of Maulana Azad and the Deoband school.
- (iii) Events leading upto the foundation of the Muslim League (1906); objectives of the League; official attitude towards the League.
- (iv) Impact of 1st World War; Congress-League Pact (Lucknow, 1916)—main features and significance in Indian Politics.

### **4. Gandhian Impact (1919-1935).**

- (i) The launching of the passive resistance movement by Gandhi : background and main features of the movement.
- (ii) Jallianwalla Bagh massacre (1919) and Gandhi's first non-co-operation movement (1919-1922).
- (iii) Suspension of civil disobedience and the formation of the Swaraj Party—contribution of 'Swarajists' (1922-27).
- (iv) Simon Commission—its boycott and the demand for Dominion Status by 1929; Lahore session and declaration of 'Poorna Swaraj' as Congress objective.
- (v) The Second civil disobedience movement (1930-34)—main features; the Round table conference in London—deliberations and outcome.
- (vi) An appraisal of Gandhi's contribution to the freedom movement.

### 5. The last phase (1935-1947).

- (i) Important political developments : Growth of socialist ideas; increasing interest by Congress in world affairs; States peoples' struggle; growth of communalism.
- (ii) 1935 Act and Provincial Autonomy—Congress ministries—rift between Congress and the League—split in the Congress—Forward Block—August offer of 1940—Jinnah's two-nation theory.
- (iii) National movement during the 2nd World War; failure of Cripps Mission—Quit India resolution—arrest of Congress leaders—violent public reaction—government repression of revolt of 1942—Subash Chandra Bose and the I.N.A.
- (iv) Post-war struggle (1945-47) : changed attitude of British government—the Cabinet Mission plan proposals—Congress and League reaction—Direct Action by the League—communal riots—Atlee's declaration of 1947—the Mountbatten plan—partition and independence.

## SECTION B

### 1. The Rise and growth of British power (1740-1798).

- (i) *Carnatic* : Anglo-French conflict—causes, course and results of the three Carnatic wars; causes of English success and French failure.
- (ii) *Bengal* : Review of main events from the accession of Siraj-ud-daulah to the defeat of the Indian powers at Buxar (1756-1764). Political arrangements made by Robert Clive; an appraisal of Clive's achievements (civil and military).
- (iii) Growth of British power under Warren Hastings; the first Anglo-Maratha war; the Second Mysore war; British relations with Oudh, Rohilkhand and Benares. An appraisal of Warren Hastings Governor-generalship.
- (iv) Cornwallis and the third Mysore war—British gains.

### 2. The Ascendancy of British power (1789-1818).

- (i) Expansion under Lord Wellesley : establishment of British paramountcy—Subsidiary Alliance, wars, annexation of territories of subordinate rulers and elimination of French influence. An evaluation of Wellesley's policy and achievements.

## ***Elective Subjects***

- (ii) **Expansion under Lord Hastings** : war with Nepal and Marathas; elimination of Pindari menace; establishment of British paramountcy in Rajputana. An evaluation of Lord Hastings' contribution.

### **3. The consolidation of British power (1818-1957).**

- (i) The conquest of Sindh.
- (ii) The conquest of the Punjab : causes, events and results of the 1st and 2nd Anglo-Sikh wars; annexation of Lower Burma.
- (iii) Dalhousie and the policy of Annexation (1848-56). Doctrine of Lapse—annexation of Oudh, other annexations. An appraisal of the Governor-generalship of Dalhousie—annexationist, administrator and social reformer.

### **4. The nature and impact of British Rule.**

- (i) The structure of government—re-organisation of the relations between the British State and the East India Company—the salient features of the Regulating Act of 1773, the Pitt's India Act of 1784, the Charter Acts of 1813 and 1833; Administrative changes after 1857—a resume.
- (ii) Political Impact : The revolt of 1857—causes ; Political, economic, socio-religious and military; spread and suppression of revolt; reasons for failure of the revolt; effects of the revolt.
- (iii) British Economic policies in India—1757-1857, Commercial policy—effects of the Industrial Revolution on economic relations with India; development of means of transport and communication; Land revenue policy—the Permanent Settlement; the 'Ryotwari' settlement.
- (iv) Economic Impact of British Rule—effect on artisans and craftsmen, peasantry, zamindars, agriculture, development of modern industries; poverty and famines.

### **5. Social and Cultural policy.**

- (i) Social and cultural policy : Characteristics of the 'New thought in Europe' (rationalism, humanism, etc.) and its

impact on Indian Society and Culture. **Humanity** measures—the contribution of Lord William Bentinck, Rammohan Roy; spread of modern education—introduction of English as the medium of instruction; an appraisal of British policy.

- (ii) **Social and Cultural awakening after 1857—Brahmo Samaj, Prathana Samaj, Arya Samaj, Ramakrishna Mission, Theosophical Society; the contribution of Raja Rammohan Roy, Dayananda Saraswati, Vivekananda, Annie Besant.**

## **6. Post-Independent India (1947-1964)**

- (i) **Problems of Partition—causes of dispute with Pakistan.**
- (ii) **Integration and re-organisation of States.**
- (iii) **Economic development : First, Second and Third Five-year plans—aims and achievements, growth in industry, increase in agricultural production; population and development.**
- (iv) **Foreign policy : Nehru—non-alignment; India's relations with Pakistan, China, U.K., U.S.A., U.S.S.R., and Afro-Asian nations (1947-1964).**

## **PAPER 2 MODERN WORLD HISTORY**

### **SECTION A**

#### **1. Prelude to 20th Century change.**

- (a) **The relations of the great European powers (1900-1914). European Alliances and conflict—Franco-German war; Russo-Turkish war and the congress of Berlin. The Dual Alliance; The Triple Alliance; The Triple Entente; Anglo-German rivalry; The Balkan wars.**
- (b) **The first World War (1914-1918) : Events leading up to the war; underlying causes of the war—Aggressive Nationalism; Economic rivalry and Imperialism; alliances; race in armaments.**
- (c) **Course of the 1st World War : The Western front; the Eastern front; S.E. Europe; Italy; the war at sea. American entry and contribution; reasons for the defeat of the central powers.**

## ***Elective Subjects***

- 2. The Search for international order between 1919-1939.**
  - (a) Peace-making after the first World War : Treaty of Versailles; Terms and German objections; merits and demerits of settlement.
  - (b) The League of nations—structure, weaknesses, successes and reasons for the failure of the League.
  - (c) International agreements between 1919-1939—Locarno, Dawes and Young plans, Washington Naval treaties, Kellogg-Briand Pact (terms; merits and demerits).
- 3. The Collapse of International Order in the 1930's.**
  - (a) Germany: re-armament and foreign policy from 1933-39.
  - (b) Japan : predominance of militarism; aggressive nationalism in the 1930's—expansion into China—Anti-Comintern pact with Germany; formation of the Axis pact.
  - (c) Italy : aggressive nationalism—invasion of Abyssinia; involvement in Spanish civil war.
- 4. The Second World War.**
  - (a) Reasons for the war : Nazi aggression; Anglo-French appeasement.
  - (b) Course of the war—Europe, Africa and Far East—Japanese aggression—initial success and ultimate defeat.
  - (c) American entry and contribution; reasons for the defeat of the Axis powers.
- 5. Tension and co-operation (1945-1970)**
  - (a) End of wartime unity : Yalta and Potsdam Conference; Rift widens—Soviet expansion in Eastern Europe (1945-47).
  - (b) The Cold War and rival alliances—Truman Doctrine; Marshall Aid; Communist coup in Czechoslovakia; Berlin Blockade, NATO and WARSAW PACT; division of Germany. Thaw in the 'Cold War' (1953-59). Crisis in East-West relations (1960-62); easing of tension (1963-66). The European movement for economic co-operation—ECSE, EEC, EFTA—progress of EEC upto 1970.
  - (c) The U.N.O.—membership, structure, agencies, weaknesses, its peace-keeping role and extent of success.

## SECTION B

1. **Italy and Germany (1919-39) : From Democracy to Totalitarianism.**
  - (i) Italy—post-war discontent and the rise of Mussolini to power.
  - (ii) Main features of Mussolini's domestic policy—introduction of the Fascist state.
  - (iii) Germany—problems facing the Weimar Republic.
  - (iv) Rise of Hitler to power and factors assisting in his rise.
  - (v) Characteristic features of Hitler's rule as Fuehrer.
2. **France (1900-70) :**
  - (i) The difficulties of the Third Republic and its collapse in 1940.
  - (ii) The fourth Republic (1945-58)—Politics, economy and foreign affairs.
  - (iii) The fifth Republic—de Gaulle (1958-69)—contribution in domestic and foreign affairs.
3. **Britain :**
  - (i) National government (1931-40)—the depression years, unemployment and government action.
  - (ii) The return of the Labour government—Nationalisation; Beveridge Report (1942) and social security; constitutional changes; Finance under Labour.
  - (iii) Conservative government (1951-64)—domestic and foreign affairs.
4. **The U.S.A. :**
  - (i) The Republican era (1921-33)—domestic and foreign policies; The great boom; The great crash (1929).
  - (ii) Franklin D. Roosevelt—the New Deal.
  - (ii) Presidencies of Truman, Eisenhower and Kennedy—domestic and foreign policies (involvement in Korea and Vietnam; relations with Latin American states).
5. **The U.S.S.R.**
  - (i) Revolution of 1917—main events leading upto the revolution; Political and economic causes of the revolution;



Lenin—problems facing Lenin and his tackling of these problems.

- (ii) Stalin—The Totalitarian State : Collectivization of agriculture, purges five year plans—estimate of contribution.
- (iii) Khrushchev—destalinisation, industrial and agricultural policy; estimate of contribution.

**6. The Far East :**

- (i) China—The Chinese Republic (1911-49). The revolution of 1911; internal developments to 1927; the Kuomintang and the Communists—causes of Communist victory.
- (ii) Establishment of the People's Republic in 1949; Mao Tse-tung Agrarian and industrial policy; Political and economic developments—contribution of Mao.
- (iii) Japan—effects of military defeat on Japan. Economic, social and political changes since 1945—post-war reconstruction.

**7. West Asia :**

- (i) Israel and the Arab states : Balfour declaration and the British Mandate; Jewish immigration; establishment of Israel; Arab-Israeli wars (1956, 1967, 1973)—causes, events and results.
- (ii) Egypt : Nasser—Domestic and foreign policy—estimate of achievements.
- (iii) Outline of developments in other West-Asian states (1947-70)—Iran, Iraq, Kuwait, Syria, Saudi Arabia, Lebanon.

## STRUCTURE OF MODERN GOVERNMENTS (852)

### Aims :

- (a) To develop in candidates an understanding of the principles of modern governments.
- (b) To provide candidates with a basic knowledge of the process of government in India and in two other important countries of the world.
- (c) To help candidates to acquire an understanding of various systems of government and broaden their outlook with a comparison of various systems.
- (d) To provide a practical introduction to the study of political science at the degree level.

There will be two papers of three hours each as follows :

*Paper 1* : (Government of India). The paper will be divided into two parts : Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

*Paper 2* : (Modern Governments). The paper will be divided into two parts : Part I will consist of short-answer questions covering the whole syllabus and will be divided into three sections—Section A (Great Britain), Section B (United States of America) and Section C (U.S.S.R.)

Part II will consist of essay-type questions set on three sections: Section A (Great Britain), Section B (United States of America) and Section C (U.S.S.R.)

Candidates will be required to answer questions as follows : Part I—All questions from two sections only ; Part II four questions, choosing two from each of two sections only.

**Paper 1 : GOVERNMENT OF INDIA (3 hours)**

### 1. Constitutional Development :

- (i) The Charter Act of 1833.
- (ii) The Revolt of 1857 to the Indian Councils Act of 1861.

## *Elective Subjects*

- (iii) The rise of the Indian National Congress—the Councils Act of 1892.
- (iv) The All-India Muslim League—the Congress demand for constitutional development the (1906 and 1908 Congress resolutions).
- (v) Minto-Morley Reforms of 1909—Hindu-Muslim antagonism.

2. 1906-1916 : Congress and Muslim League approaches—the 1916 Lucknow pact—main features.

3. The Montagu-Chelmsford Report on Indian Reforms, (cf. Durham Report for Canada)—The Act of 1919—The Working of diarchy—Swaraj and Dominion Status—The Nehru Report.

4. The Simon Commission 1927 and the Simon Report—The Round Table Conference (three sessions)—The Act of 1935 and its working—The impact of World War II.

5. The Cripps Mission—The Indian Independence Act 1947.

6. The work of the Constituent Assembly—The drafting committee.

7. The Indian Constitution—General character—Preamble—Directive Principles of State Policy—Citizenship and Fundamental Rights.

8. The Union Executive—The President—The Vice-President—The Prime Minister—The Cabinet—Ministerial responsibility.

9. The Houses of Parliament—Lok Sabha—Rajya Sabha—role—composition—the conduct of elections—the Speaker.

10. The State Executive and Legislature—Governor—Chief Minister and Cabinet—The State Legislatures—role—composition.

11. Parliament and State Legislatures in action ; sessions and sittings—Rules of Procedure—Debates—Votes and Divisions—Introduction of Bills, Readings and Assent—Private Bills.

12. The Indian Judicial System : The Supreme Court—composition—appointment—role and functions.

The High Court—composition—appointment—role and functions—relations with the Supreme Court.

The District Courts—functions and relations with Higher Courts.

13. Local Self-Government in India : Municipalities—Corporations—Zilla Parishad—Panchayati Raj.

## *Structure of Modern Governments*

14. Federal and Unitary features of the Indian Constitution—relations between the Union and the States—emergency provisions—amendments to the Constitution.

### **Paper 2 : MODERN GOVERNMENTS (3 hours)**

A study of the structure and working of *two* modern Governments :

Section A. Great Britain ;

Section B. United States of America ;

Section C. U.S.S.R.

### **Section A**

#### *Government in Great Britain*

1. *Nature of the British Constitution :*  
British constitution—development—elements of the Constitution—methods of constitutional development—major features of the constitutional system.
2. *The Monarch and the Crown*—role of the Crown : executive, legislative, other functions—the Monarch's role in Government.
3. *Privy Council, Ministry and Cabinet* :  
The Privy Council, membership and functions.  
Composition of Ministry and Cabinet—designation of a Prime Minister—selection of other Ministers. Cabinet—chief executive and legislative functions—relations to Parliament—place of the Prime Minister—ministerial responsibility.
4. *The Houses of Parliament :*
  - (a) The House of Commons : meeting place—composition—distribution of seats—the conduct of elections—officers of the House of Commons, the Speaker, the Committee System—individual members.
  - (b) The House of Lords : meeting place—composition—organization—the Parliament Acts of 1911 and 1949 and the reforms of 1957-1958—the role of the House of Lords today.
5. *Parliament in Action* : Session and sittings—Rules of Procedure—Debates—Votes and Divisions—Introduction of Bills. Reading and Assent—Private Bills.

## *Elective Subjects*

### 6. *The Welfare State :*

Definition and development of the Welfare State in Britain—National Insurance—National Health Service—Legal Aid Scheme—Housing—Food and Agriculture—Public Planning.

### 7. *Law and the Courts :*

Common Law—Statute Law and its relations to Common Law—Equity—General character of the Court System—Civil Actions—Criminal Actions—The House of Lords as a Court.

## **Section B**

### *Government in the U.S.A.*

#### 1. Important features of the Constitution—Federal centralization—Growth of the Constitution.

#### 2. *The Presidency :*

Procedure for election—Powers and functions of the President—Executive powers—Judicial powers and Legislative powers—the President and the Constitution—the increase in the powers of the President—the President's Cabinet.

#### 3. *The Congress :*

The Vice-President—the Senate—Powers of the Senate—the House of Representatives—the Speaker—the powers and functions of the Congress—the Congress and the President—process of law making—financial control and the Committee system in the U.S.A.

#### 4. *The Supreme Court :*

Appointment of Judges to the Supreme Court—Powers of the Supreme Court—the doctrine of implied powers—the Supreme Court and civil liberties—the Supreme Court and the Constitution.

#### 5. *Party System in the U.S.A. :*

Character of the party system—history of political parties—permanent party organization—periodic organisation.

#### 6. *The State Governments and administration :*

Division of powers—the State Executive—the State Legislature—the State Judiciary—Local Government.

**Section C**

*Government in the U.S.S.R.*

1. *Constitutional Development :*

Russia before 1917 and the **Red** revolution—basis of the **Soviet Regime**--Communist leaders and Communist writings—**Laws** and **Decrees**—formal **Constitution**--major characteristics of the **Soviet System**.

2. *The Communist Party :*

The **Party** and the **State**--the general character of the **Party**--membership in the **Party**--central organisation of **Primary Party**—organization at the regional and district levels—**Primary Party** organs—voting and elections.

3. *Instruments of the Communist Party :*

**Youth Organizations**--**Schools** and **Universities**--the **Political Police**--the **Red Army**--the **Press, Radio** and **Television**--**Labour Union**--**Cultural Programmes**.

4. *The Government Machinery :*

The **Supreme Council**--the **Council of Ministers**--**Laws** and the **Courts**.

5. *Public Planning :*

**Development of Planning**--the **State Planning Commission**--the problem of **integration**--the **plans**--**planning achievements**.

6. *Activities of the Party-State :*

**Communist concept of property**--**State Farms**--**Collective Farms**--**State Industries**--**Procedural Co-operatives**--**Retail Business**--**Public Welfare**.

7. *Regional and local governments :*

The **Constituent Republics**--the **Russian Soviet Federated Socialist Republic**--**Territories** and **Nationality areas**--**urban places** and **villages**.

## GEOGRAPHY (853)

### **Aims :**

- (a) To understand and perceive the interaction and relationship of natural forces ;
- (b) To develop through the study of man in different environments an understanding of the interdependence of the peoples of the world ;
- (c) To enhance the feeling of belonging to one's own country and to develop this feeling as a catalyst for a balanced growth of national sentiment and responsible citizenship ;
- (d) To lay the basis of international mind ;
- (e) To recognise the contribution of geographical thinking to the analysis of contemporary problems.

### **General consideration.**

“Geography, as a bridge between the arts and sciences, continually looks to the future. Though it is a *science* of observation encouraging the development of the powers of discrimination and correlation, it should be taught in such a way that the physical aspects do not take precedence over the study of the all-important relationship between man and his environment. Conceived thus, geography can contribute much to international understanding.”

The emphasis is on the environment most familiar to candidates of the region and to teachers with an opportunity to study the local region in greater depth provided by questions which enable the choice and analysis of local examples whenever possible in the answer.

There will be *three* papers as follows :

### **Paper 1 (3 hours)**

*Candidates must answer five questions, including one from each section.*

**Section A**

*Map Reading and interpretation of Survey maps.* Representation of geographical data in maps and diagrams. Representation of topographical features on maps. Scales and profiles. Questions may be set involving (a) grid references, conventional signs, gradients, the measurement of distance and orientation ; (b) the description of relief and drainage, settlement patterns and communications.

**Section B**

*Landform and Processes.*

- (a) Landforms resulting from folding, faulting and volcanic activity with examples chosen for study from South and South-East Asia.
- (b) The work of running water : river erosion, transportation and deposition. Landforms of river valleys including the shape and form of the valley in the upper, middle and lower regions, waterfalls, gorges, meanders, floodplains, levels and deltas. The causes of and problems produced by seasonal flooding. Local Indian examples should be chosen for study wherever possible.
- (c) Water resources and conservation in India with particular references to ground water, water tables, springs, problems of water storage and the use and misuse of water for irrigation.
- (d) Landscapes in dry climates including dunes, wadis and oases ; sandy deserts ; rock and stony deserts ; mountain regions of aridity. All studies and examples may be selected from Iran, Baluchistan, Afghanistan, Pakistan, India.
- (e) Coastal landforms and marine processes as seen on the coastline of India ; erosion and deposition, the formation of cliffs, stacks, caves, abrasion platforms, beaches, sand bars and spits, dunes and coastal marshes, estuaries, and delta landforms. The problem of coastal protection of low-lying parts of the Indian coastline.

In each section the study of local maps and photographs should be encouraged and questions may be set on the description and analysis of photographs. In any section credit will be given to work presented showing local knowledge and field work.



## *Elective Subjects*

### **Section C**

#### *Weather and Climate.*

- (a) Weather study based mainly on local observation and the use of simple weather maps. Measurement of the elements of weather. The use of the maximum, wet and dry bulb, thermometers, the rain gauge, the barometer and the wind vane. Observations and recording of cloud type and wind force.
- (b) The formation of relief, convectional and cyclonic rainfall.
- (c) A study of weather types associated with the cool dry season, hot dry season and monsoon season in India.
- (d) The chief factors including the climates of the equatorial tropical monsoon, tropical desert, Mediterranean, cool, temperate, western margin, taiga and tundra climates, together with their chief annual and seasonal features of temperature, rainfall and winds.

### **Section D**

#### *Vegetation and Soils*

The simple processes of soil formation ; the characteristics of common soil types in India (laterites, regur soils, soils affected by salination) ; soil profiles of podsols, lateritic soils, alluvial soils. Causes of soil erosion in India and South-East Asia ; the problem of salination due to irrigation ; methods of soil conservation.

The description of 'natural' vegetation and factors influencing it with special reference to tropical rain forests, tropical grasslands, tropical desert vegetation and vegetation in tropical highlands and in tropical deltas. Examples may be confined to India and South-East Asia.

#### **Paper 2 (3 hours)**

*Candidates are required to answer five questions ; two from Section A, two from Section B and the remaining question from either Section A or Section B.*

#### **Section A.**

##### *India and Asia excluding U.S.S.R.*

1. The broad outlines of the relief, structure, climate and vegetation of Asia, with special reference to India.

2. *Agriculture*

(i) *Types of Farming*. Subsistence and commercial farming, paastoral nomadism, shifting agriculture, wet-rice agriculture, plantation, commercial pastoralism, commercial arable and mixed farming, dairying, market-gardening and fruit-farming.

Examples, where possible, should be chosen from India and South-East Asia.

(ii) *Irrigation In India* with comparative and contrastive studies in Thailand, Malaysia, Java.

Reference should be made to :

- (a) primitive methods : wells, inundation canals, tanks, water wheels, learez.
- (b) modern methods : perennial canals, dams and tube wells.
- (c) the dangers of over-watering.
- (d) multipurpose projects : Damodar; Kosi; Tungabhadra; Bhakra-Nangal ; Nagarjansagar ; Rihand ; Narmada.

(iii) *Crops in India* with comparative and contrastive studies in countries whose names are given in brackets after each crop :

(a) *Food Crops* :

Rice (China, Japan, Java) ; wheat (China—Yangtse Valley and Pakistan) ; maize (China and Thailand).

Cultivation of coarse grains in India such as *sorghum* (jowar or cholam) *pennisetum* (bajra or camboos) ; *eleusine* (ragi) and pulses must be studied.

(b) *Commercial and Industrial Crops* :

Tea (Sri Lanka and China) ; coffee (Sri Lanka) : cotton (China, Hwangho plain and Pakistan) ; sugar-cane (Philippines and Burma) ; rubber (Malaysia) ; jute (Bangla Desh); groundnuts (the Philippines and China); tobacco (the Philippines and Burma) : coconut (Sri Lanka and the Philippines).

*Oilseed* cultivation in India must be studied. (Compare soya been cultivation in China).

*Note 1.* The study will include : conditions of growth, methods of cultivation ; methods of production : world production and India's share.

## *Elective Subjects*

*Note 2.* The study of *plantation agriculture* will include land areas ; capital : labour : modern developments.

### 3. *The development of forestry.*

Factors and methods influencing forest exploitation, uses, production and trade in timber in India, Burma and the Philippines.

### 4. *Fishing.*

Fishing methods, type of fish caught, fishing grounds and factors influencing their importance and development, fishing ports and markets. The study should pay particular attention to India, Cambodia and Japan.

### 5. *Industrial location.*

(i) Factors affecting industrial location : sources of fuel and power, sources of raw materials for industrial development, other factors such as water supplies, labour, capital, communications, markets in India.

(ii) Examples of industrial development in India and Japan with reference to :

- (a) iron and steel manufacture ;
- (b) some steel using industries ; ship building, motor-car manufacture, engineering industries ;
- (c) textiles ;
- (d) chemicals.

### 6. *Settlement and population studies.*

The distribution of population and the causes and consequences of the population problem of India, together with a study of :

(i) rural settlement patterns and the factors which influence them in India.

(ii) the factors influencing the location and growth of urban centres in India.

(iii) the problems resulting from the growth of great cities.

**Studies should be made of at least three great cities of India and three in other parts of South-East Asia.**

### 7. *The pattern and problems of communication in India and South-East Asia.*

**Candidates may use sample studies to illustrate their answers and credit will be given for illustrations drawn from local examples of their own field studies.**

**Section B.**

*World Studies.*

The topics in Section B are closely related to those of Section A and candidates are advised to study them in similar ways.

1. *Agriculture, Forestry, Fisheries.*

A study of the following :

- (a) farming in mountain regions of Europe.
- (b) coniferous forests of North America : timbering.
- (c) land reclamation in the Netherlands (polder and heath).
- (d) dairy farming in New Zealand *and* the New England region of the U.S.A.
- (e) wheat farming on the Prairies of Canada *and* the U.S.S.R.
- (f) irrigation in Egypt.
- (g) soil erosion and conservation in the U.S.A. *and* in Africa.
- (h) the fishing industry of Peru *and* the Atlantic provinces of Canada.

2. *Industrial Studies.*

- (a) Sources of fuel and power location, resources and factors affecting the development and use of coal (West Germany), petroleum (Middle East and U.S.A.) and natural gas (North Sea), hydro-electric power (Australia and British Columbia) nuclear power for industry (general world survey).

- (b) Minerals; the location and production of: iron, copper, tin, bauxite.

Minerals for the chemical industries : salt, potash, anhydrite, phosphates, coal, petroleum.

Candidates should have some knowledge of major sources of minerals used in industrial development in Western Europe and North America.

- (c) Major sources of the textile fibres, both natural and man-made.
- (d) The location, growth and development of industries with special reference to the iron and steel, steel using,

chemical and textile industries of the following regions:

- (i) Germany.
- (ii) The Pittsburg and Great Lakes region of the U.S.A.
- (iii) The U.S.S.R.

3. *Population Studies.*

The factors influencing the distribution and density of population with particular reference to Western Europe and Africa, South America, Australia.

4. *Transport and Trade.*

The pattern and problems of international transport including the growth of ports and airports.

The study of trade will be expected *only* in relation to the studies of agriculture etc., and industry outlined above.

**Paper 3 : Practical**

Candidates will be required to undertake *practical* and/or *project* work in *one* or more of the *five sections* (see below) and prepare a work book and other material such as plans, maps, posters, etc., of the research related to the practical and/or project work undertaken during the two years of preparation for the examination. This evidence of practical and/or project work will be assessed by a Visiting Examiner approved by the Council and the marks obtained will be added to the result of the *two* theory papers.

1. *Indian Daily Weather maps*

Information, representation and symbols. Weather observations : operation of a school weather station ; interpretation and the use made of the weather data during one year.

2. *Map projection.*

Uses, constructions, properties and characteristics of the following projections :

- (i) Cylindrical Equal-area ;
- (ii) Simple Conical – one and two standard parallels ;
- (iii) Zenithal Equidistant ;
- (iv) Mollweide's.

3. *Chain.*

Description and use of chain equipment (excluding the optical square). Fieldwork in simple chain survey including :

- (a) use of offsets,
  - (b) overcoming obstructions to chaining.
  - (c) fixing the boundaries of small impenetrable areas from outside (e.g. of buildings, dense woods, water bodies).
- Knowledge of booking and plotting chain surveys.

4. *Either*

- (a) *Compass.* Description and use of the prismatic compass. Fieldwork in compass sketching and traversing. Booking and plotting (including graphical adjustment).

*Or*

- (b) *Plane Table.* Description and use of plane table equipment. Fieldwork in plane table survey :
  - (i) from a point (radiation),
  - (ii) from a base line (intersection),
  - (iii) along a simple traverse. The use, but not the proof, of resection in plane table survey.

5. *Fieldwork*

Field exercises based on local data, for example :

- (a) The mapping of urban land use.
- (b) The mapping of rural land use.
- (c) A farm study.
- (d) A port study.
- (e) A study of some landforms

## SOCIOLOGY (854)

### Aims :

- (a) To develop in candidates an understanding of the various forces that constitute social life and social problems.
- (b) To provide candidates with the means whereby they can come to a better understanding both of other cultures and of their own.
- (c) To form in them the habit of scrutinising social assumptions and beliefs in the light of scientific evidence.
- (d) To provide an introduction to a deeper study of the subject at the degree level.

There will be *two* papers of *three* hours each as follows :

*Paper 1* (Sociology) : The paper will be divided into *two* parts

Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

*Paper 2* (Social Anthropology) : The paper will be divided into *two* parts :

Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

### Paper 1 : SOCIOLOGY (3 hours)

1. *Origin and development of sociology* :—Society and sociology—method of sociology—relation of sociology with other social sciences.

2. *Social groups and institutions* :—Community and association—nature of institution—attitudes and processes of social life—cooperation and conflict.

3. *The nature of society* :—Society and the individual—man as a social being. The nature of social unity—the mainsprings of social life—the origin of society.

4. *The family* :—Characteristics of the families—essential features—origin of the family—types of family—changes in the family—the modern Indian family—the family and society.

5. *The state* :—Origin and development of the state—the state as an institution of force—various theories—socialism, communism, democracy—the welfare state.

6. *The economic system* :—Economic activity and society—early industrialism—modern industrialism—the human conception of work—social inter-relation in industry—industry and the social system.

7. *Morality and religion*.—Notion of morality—extension and objectivity of the moral code—the social role of morality—general concepts of religion—the religious fact and its development—the social role of religion—relations between religion and morality.

8. *The educational system* :—Meaning of education—ends of education—means of education—development of education—types of education—humanistic, scientific, vocational. The role of the teacher in education and the state.

9. *Heredity and environment* :—The mechanism of heredity—genetic changes and acquired characteristics—notion and types of environment—interplay of heredity and environment.

10. *The race problem* :—Concept and claims of race—the unity of mankind—differences between human groups.

11. *Culture and civilization* :—Notion of culture and civilization—distinction between culture and civilization—the role of technology in social life—the concept of 'Cultural Lag.'

12. *Social stratification* :—Elements of social stratification—the class system—nature and development—the caste system—concept and general features—caste and class.

13. *Natural and Social selections* :—Natural selection and the survival of the fittest—social selection—rural and urban communities as agencies of social selection—contacts between city and country life—social change in rural India.

14. *Population* :—The population pattern as an agency of social selection—population and food supply—population in India—social change in Indian cities.



## *Elective Subjects*

15. *Social evolution and progress* :—Concept of social evolution—theories of social evolution—the idea of progress.

### **Paper 2 : SOCIAL ANTHROPOLOGY (3 hours)**

#### 1. *Definition and scope of anthropology* :

Branches of anthropology and their inter-relation. Relations of anthropology with natural and social sciences. Work of political philosophers, travellers, explorers, administrators and missionaries ; emergence of anthropology. Scope of applied anthropology ; anthropology and modern life ; the future of applied anthropology in India.

#### 2. *Anthropology, Cultural and Social* :

Definition and attributes of culture ; culture determinism ; culture and the individual : culture and civilization. Theories of culture growth ; evolution : diffusionism. Theories of cultural integration ; functionalism ; patterns of culture.

#### 3. *The family* :

Some primitive families : the Kharia, the Ho and the Khasi. The family as a function unit. The family as an association : various types of families : sib and gotra.

Distinctive features of the family.

Historical origins of the family ; Morgan's evolutionary scheme ; Westermarck's extremist interpretation of the evolution of the family, and Briffault's criticism : the functional theories. The family in the West, among Indian tribes, Hindus and Muslims.

#### 4. *Marriage* :

Marriage among the Kharia, the Ho and the Khasi. The reasons underlying marriage and its nature. Various forms of marriage. Ways of acquiring a mate ; inheritance of widows. Divorce. Marriage among the Hindu and the Muslim societies. The status of women in tribal society ; Matriliney among the Khasi and the Garo ; status of women in patrilocal societies.

#### 5. *Kinship* :

Types of kinship : consanguineous and affinal.

Degree of kinship range of kinship system descent, kinship usages, kinship terms ; classificatory and descriptive examples.

6. *The Clan and Totemism*

Basis and features of a clan and types of kinship groups other than the family.

Clan organization among Indian tribes.

Totemism in India and elsewhere : explanatory theories.

7. *Associations and Dormitories :*

Definition and various types of association : Schurtz's scheme: age grades or classes. Dormitories in India; their internal structure, activities and functions : the effects of culture contacts upon dormitories. Education.

8. *Religion and Magic :*

Theories on the origin of religions : animism, animatism, manaism, naturism and functionalism.

Magic : imitative and contagious magic, religion and science ; fetishism. Taboo, its nature and explanation. Tribal religions in India ; Bongaism.

9. *Art :*

Art in relation to the individual and society; style and genius : evolution of art. Pre-and proto-historic art; in Europe and in India.. Art in contemporary primitive society; theoretical background; art among Indian tribes.

10 *Economic Organizations :*

Growth of types of economic organizations. Classification of economic organizations with Indian examples. The nature of primitive economics : sexual division of labour; property in primitive economies. Economics of Indian tribes ; food-gathering, agriculture, shifting axe-cultivation, handicrafts, pastoralism and industrial labour. The economic life of the Kadar, the Toda and the Ho.

11. *Law and Justice :*

Nature of primitive law ; its differences from modern law. Establishment of crime; punishment ; compensation. Sanctions behind law in primitive society, government. Law among the Kamar, the Kharia, the Rengma Naga and the Ho.

## ***Elective Subjects***

### **12. Rank, Caste and Tribe :**

The view of primitive society as a democratic organization; definition of rank and status, class and caste.

Caste in India; its nature and general features; caste origin; racial, occupational, functional, and other viewpoints. Utility of the Indian caste system, and its uniqueness. Differences between caste and tribe. Group dynamics : conversion of castes into tribes. Social organization among Indian tribes. Islanders, the Kadar, the Ho, the Munds, the Khond, the Gond, the Khasi and the Toda.

### **13. Tribal India : Past, Present, and Future :**

Geographical location ; linguistic affinities ; racial affinities ; cultural levels ; classification on cultural basis : economic grading.

Present conditions and problems : economic and socio-cultural. Problems arising out of isolation and exploitation.

Action by the Government ; British policy : post-1947 policy ; constitutional safeguards. Future prospects.

## PSYCHOLOGY (855)

### Aims :

- (a) To give the student an increased understanding of the nature of man as an individual and as a member of a social group.
- (b) To lead him to understand that there exists in Psychology an academic discipline which is concerned with some of the problems which affect his personal and social life. :
- (c) To give him some familiarity with the methods of study which are employed in the solution of problems in **this** field.

There will be *two* papers of *three* hours each as follows :

*Paper 1* : The paper will be divided into *two* parts :

Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

*Paper 2* : The paper will be divided into *two* parts :

Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

### Paper 1 : (3 hours)

1. *The subject matter of Psychology*—Methods of scientific psychology—Aims and purposes of Psychology—Branches and Schools of psychology.

2. *Heredity and environment*—The problem of heredity and environment—How heredity works—The role of environment.

3. *The Psychology basis of behaviour*—The sensory receptors—The human nervous system—The brain—Localization of brain function—The autonomic nervous system—reflex action—muscles and glands.

4. *Perception and Attention*.—The importance of attention in perception—The nature of perception—factors determining percep-

## *Elective Subjects*

tion—the perceptual process—organising factors in perception—errors in perception—aesthetics and perception.

5. *Feelings and Emotion*—The nature of feelings—Sensation and feeling—Conscious awareness of an emotion—Emotions—Emotional expression—Physiology of the emotions—Controlling the emotions.

6. *Motivation and adjustment*—Physiological motives—“instincts” as motives—Psychological motives—Social motives—Conflicts among motives—adjustment to conflict.

7. *Learning : Principles and Methods*—The nature of learning—Basic principles of learning—Methods of learning—Learning and maturation—Habits and habit formation.

8. *Remembering and Forgetting*—Aspects of memory—Fixation and retention—Factors influencing retention—Recall and recognition : Factors influencing recall—Forgetting : Causes of forgetting—Theories of forgetting—Memory training.

### **Paper 2 (3 hours)**

1. *Thinking and Reasoning*—The nature of thinking : Problem solving—Thought and language—The formation of concepts—Reasoning : The value and importance of reasoning—Training in thinking and reasoning—Creative thinking.

2. *Measurement in Psychology*—The frequency distribution—Average—Variability—Units of measurement : the Age scale, percentile scale, sigma scores, standard scores, T scores.

3. *Intelligence*—The nature of intelligence—Theories of intelligence—The measurement of intelligence—Kinds of intelligence tests—Value and limitations of intelligence tests—Levels of intelligence—Aspects of intelligence measurements—The influence of heredity and environment on intelligence.

4. *Individual Differences and Aptitudes*—Differences among individuals—Differences among groups—The distinction between aptitude and achievement—Trait differences—Factors making for differences—Tests of general and specific abilities—Aptitude in the professions—Aptitude in Music and Art.

5. *Personality*—Characteristics and elements of personality—Theories of personality organization—Determinants of personality—Measuring personality—Biological and social factors in personality—The integration of personality—The abnormal personality.

6. *Social behaviour*—Socialisation—social norms—social attitudes—prejudice—group psychology—group behaviour—group structure—the individual and the group—social growth in infants and adolescents.

7. *Attitudes and related social traits*—The nature of attitudes—Personal and social values—Attitude formation and change.

8. *Applications of psychology*—At home and at school—vocational guidance—psychology in industry—criminal psychology—clinical applications—marriage guidance—propaganda.

## ECONOMICS (856)

### Aims :

- (a) To develop the capacity of candidates to think in economic terms.
- (b) To acquaint candidates with methods of economic analysis.
- (c) To develop an understanding of important economic problems.
- (d) To acquaint candidates with the main institutions through which the productive process is carried out.
- (e) To provide an understanding of present day economic problems and institutions and to develop an understanding of the economic structure in which the candidate lives.
- (f) To enable candidates to compare their own economic structure with that of other areas of the world.

The course should be regarded as providing the future citizen with basic knowledge about the economic system as well as arousing interest for further studies in economics.

There will be *two* papers of *three* hours each.

*Paper 1* (Economic Theory) : The paper will be divided into *two* parts :

Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

*Paper 2* (Indian Economics) : The paper will be divided into *two* parts :

Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

**Paper 1 : ECONOMIC THEORY (3 hours)**

1. *The Economic System* : nature and scope of economics ; basic problems of scarcity and choice ; the concept of opportunity

cost ; price mechanism and resource allocation ; advantages of specialisation and exchange including international trade ; comparative costs in international trade.

2. *The Productive Mechanism* : The functions and characteristics of the factors of production : forms of business organisations, such as sole proprietorships, partnerships, joint stock companies, co-operative societies, state enterprises ; the growth of public enterprises in modern times ; justification for their existence in free societies along with private enterprises ; monopolies and combinations.

3. *The Pricing of Products and Factors* :

(i) The elements of demand and supply ; the demand schedule and curve ; the supply schedule and curve, shifts in the demand and supply functions.

(ii) The elaboration of the demand function, determinants of individual demand ; price, tastes, income and substitutes : market demand ; price and income elasticities.

(iii) The elaboration of the supply function ; the supply function of an individual firm ; types of costs, factor substitution and cost minimisation, internal and external economics of scale, the laws of return, short and long run cost curves, the supply function of an industry.

(iv) The equilibrium of the firm and industry under perfect, imperfect competition and monopoly. The control of monopoly.

(v) Returns to the factors of production ; the marginal productivity theory as applied to the determination of wages, interest, profits, and rent.

4. *Money* : Evolution, functions and types of money ; credit creation ; role of banks in the economic system. The Central Bank and its functions.

The quantity theory of money ; equation of exchange and the price level ; liquidity preference ; compilation and use of price indices.

The nature and consequences of inflation ; the role of the Central Bank as controller of the money supply.

5. *The National Income* : National income ; concepts and definition ; meaning and measurement, difficulties in the measurement,



## *Elective Subjects*

problems of comparison over time and between countries ; factors that determine the size of income : inequalities of income and measures to reduce such inequalities in income distribution ; the uses of national income data ; national income and national welfare.

6. *Public Finance Determinants of levels of Income and Employment : Classical Analysis :*

(i) Keynesian analysis of employment in closed and open economies.

(ii) Types of unemployment : the problems of stabilisation and growth in open economies.

(iii) Budgetary surpluses and deficits as fiscal weapons.

7. *Public Finance :* The nature and significance of taxes and subsidies ; the public debt, its structure and management ; budgetary and fiscal policy relating to the objectives of equity, stability and growth.

8. *International Trade :* The balance of trade ; the terms of trade ; the balance of payments ; foreign exchange ; exchange rate determination ; gains from international trade.

9. *Problems of Economic Development :* Characteristics of under-developed economies ; the role of the entrepreneur ; capital formation, inventions and innovations. Population and economic growth.

### **Paper 2 : INDIAN ECONOMICS (3 hours)**

1. *The Indian Economy :* Economic resources : the changing economic pattern with special reference to the period of planning.

2. *Population :* Age and sex compositions ; occupational distribution, population growth ; population policy.

3. *The Low Income of India :* Its dimensions : reasons for the poverty line in India ; attempted solutions and their effects ; inequalities of income distribution in the Indian context ; efficacy of the measures adopted to reduce inequalities.

4. *Problems of Indian Agriculture :* The food problem ; land tenures ; marketing and warehousing ; rural credit ; landless labourers ; disguised unemployment.

5. *Indian Industries :* Some major industries—cotton textile, iron and steel, sugar and jute industries ; small scale and cottage

**industries ; industrial finance ; industrial labour ; industrial policy ; the role of public sector industries.**

6. *Transport and Communications* : Road transport ; rail transport ; rail-road co-ordination ; water transport ; air transport ; communication systems ; state take-over of transport and communication systems.

7. *Labour* : Trade unions ; labour legislation ; machinery for settlement of industrial disputes.

8. *Currency and Banking* : Features of the Indian money market ; the role of commercial banks ; land mortgage banks and cooperative banks ; the Reserve Bank of India and its functions ; foreign exchange ; the International Monetary Fund.

9. *Finance* : Institutions of the capital market ; stock exchanges ; facilities for short term and long term finance for agriculture, industry and commerce. Changes during the period of planning.

10. *Economic Policy and Planning* : The need for planning in India—formulation implementation of plans at various levels ; the planning machinery ; the Five Year Plans ; a critical study of the Plans.

## STRUCTURE OF COMMERCE (857)

- Aims :** (a) To provide a study of the more important aspects of the commercial world.
- (b) To provide knowledge of the activities of commerce in the marketing of goods and services.

The syllabus provides a study of the structure of the world of commerce. The main emphasis is on commerce in the home trade but candidates will be expected to have some knowledge of international activities.

Some knowledge is also expected of the main procedure and documents in the daily conduct of business but more attention should be given to commercial institutions, their inter-relationship and the part they currently play in commerce. Candidates should be aware of the purpose and broad organisation of such institutions as bankers, clearing houses, stock exchanges, marketing boards, Llyod's, but a detailed knowledge of their working is not expected.

Questions involving simple calculations may be set.

The arrangement of the items of the syllabus does not mean that they should necessarily be taught in that order.

There will be *two* papers of *three* hours each as follows :

*Paper 1* : The paper will be divided into *two* parts :

Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

*Paper 2* : The paper will be divided into *two* parts :

Part I will consist of short-answer questions covering the whole syllabus, and Part II will consist of essay-type questions.

Candidates will be required to answer *all* questions from Part I and *four* questions from Part II.

### Syllabus

#### **Paper 1 : (3 hours)**

**Introduction.** Human wants and their satisfaction by the pro-

duction of goods and services. The need for commerce as the result of specialisation by individuals, regions and nations.

**1. Trade.** Its nature and purpose.

(a) *Retail trade.* Functions of the retailer. Factors to consider in establishing a retail outlet. The main characteristics of small-scale and large-scale retailing (including co-operative societies and the local retail market).

Trends in retailing : e.g. branding, packaging, self-service, after sales service, mail order, trading stamps, voluntary chains ; retail trade associations : the reasons for the trends and their effects. Hire purchase : the nature of the transaction ; its advantages and disadvantages ; comparison with deferred payments. Protection of the consumer : the part played by voluntary associations, legislation, statutory bodies.

(b) *Wholesale trade.* Functions of the wholesale merchant and of agents (including brokers and factors). Trends in wholesaling : e.g. the forces making for the elimination and survival of the independent wholesaler, cash and carry warehouses the organisation of voluntary chains. Co-operative wholesale societies : their ownership and functions. Organised wholesale and produce markets : their work in the collection and distribution of home produce and imported foodstuff and raw materials. Marketing boards for agricultural produce ; reasons for establishing such boards and their functions.

(c) The functions of the main documents in the home trade : quotation, catalogue, order, invoice, debit note, credit note, statement of account. Trade and cash discounts.

(d) *International trade.* Distinction between home and international trade. The main characteristics and procedure of international trade. The Customs and Excise : their functions, including the collection of duties, statistical recording of exports and imports, enforcement of quotas, controlling bonded warehouses. The middlemen of international trade (including merchants, factors, brokers, forwarding agents) and their functions. The purpose of the main documents in international trade, including the invoice, indent, bill of lading, insurance policy.

**2. Communications.** The necessity for rapid and accurate transmission of commercial information. The Post Office and other authorities

## *Elective Subjects*

concerned with the availability and control of communication services. The appropriate use of the various methods of communication.

### **3. Transport.**

(a) Transport by road, rail, inland waterway, sea and air. Consideration of the characteristics of each method of transport and the factors governing the choice of method. Comparison and contrast between e.g. road and rail, rail and freight liner and passenger train (for carriage of goods), cargo liner and tramp, airliner and chartered plane.

(b) Modern developments and trends ; e.g. containerisation, OBO (oil, bulk, ore) ships, air cargo.

(c) Functions of the main documents involved e.g. consignment note, bill of lading, charter, airway bill.

(d) Importance of (i) harbour and dock facilities, (ii) airport facilities : the broad organisation of seaport authorities and of airport authorities (such as the International Airports Authority of India) and their work in maintaining the port in a state of efficiency.

**4. Warehousing.** The necessity for storage, including its importance in connection with seasonal production and demand. Functions of different types of warehouses in home and foreign trade : the wholesalers, the depots of manufactures and of supermarkets and other large scale retailers : cold storage ; port authority and other public warehouses : bonded warehouses.

### **Paper 2 : (3 hours)**

#### **1. The Business Unit.**

(a) The distinguishing features of each form of business unit with particular reference to ownership, control, the allocation of profits (or surplus).

(i) *Private enterprise* : the sole trader, partnership, companies and corporations with limited liability (including, in outline, the supernational—or multi-national—corporation).

(ii) *Public enterprise* : national corporations, regional boards, public utility corporations e.g. gas, electricity, water, transport.

(b) *The finance of business unit.* The trader's capital : its

sources ; **fixed assets and fixed capital** ; working capital ; its meaning and importance. **Gross and net profits, turnover, rate of stock-turn** ; their meaning, calculation and inter-relationship ; **the relationship of net profit to capital invested and to turnover.**

## **2. Finance and banking.**

(a) **The means of payment** ; cash (notes and coin) ; post office facilities ; postal and **money orders, banking facilities** : cheques, credit transfers, standing orders, direct debiting giro.

(b) **Banking** : current and deposit accounts ; cheques ; general and special crossings, endorsements, negotiability ; the work of bankers' clearing houses ; the finance of home and foreign trade including loans and overdrafts, documentary credits, cable transfers. Other banking services. The finance of hire-purchase.

## **3. Insurance.**

(a) **The risks of business and distinction between insurable and non-insurable risks. Statistical basis of insurance.**

(b) **Essentials of a valid contract of insurance** : indemnity, insurable interest, utmost good faith.

(c) **Different types of insurance offices** : composite and specialist ; **functions of the Life Insurance Corporation of India.**

(d) **Lloyd's** : its organisation, functions and activities.

(e) **Outline of procedure in effecting an insurance policy and making a claim.**

(f) **Insurance brokers** : their functions.

(g) **The work of the Export Credits Guarantee Department.**

## **4. Advertising** : Purpose ; methods of appeal ; benefits, dangers. Informative and persuasive ; collective and competitive. The different forms and media and their appropriate use. Advertising agencies : their functions ; their organisations ; codes of advertising practice.

## PRINCIPLES OF ACCOUNTS (858)

**Aims :**

- (a) To provide an understanding of the principles of accounts, and practice in recording transactions, and interpreting individual as well as company accounts.
- (b) To understand the form and classification of financial statements as a means of communicating financial information.

**NOTE :**

(i) The arrangement of the items of the syllabus is not necessarily to be taken as an indication of the sequence in which they should be taught.

(ii) The examination will test the candidates' understanding of the principles of accounts, their ability to record transactions by double-entry book-keeping, and to interpret accounts.

### SYLLABUS

There will be *two* papers of *three* hours each as follows :

**Paper 1 (3 hours)**

#### **1. Data and Records**

(a) Modern methods of processing data, but questions will not be set on mechanised accounting or on the operation of computers ;

(b) the necessity for accurate records as an aid to efficient management, their value as a record of past performance, and as a guide for future policy ;

(c) the distinction between the records of transactions and the transactions themselves, and the distinction between Capital Receipts and Revenue and between Capital and Revenue expenditure ;

(d) classification of accounts, principles of double-entry book-keeping.

**2. The main documents, subsidiary books and the ledger**

(a) **Documentary records** : invoice, credit note, debit note, cheque, voucher, receipt. Methods of original entry based on the documents.

(b) **Subsidiary books** : the journal ; rules of journalising, use of journal proper ; subsidiary journals (day books) : purchases book, sales book, returns inward book, returns outward book ; use of columnar records. Correction of errors by journal entry.

(c) **The Ledger** : Forms of ledger accounts. Posting to the ledger ; *folios* ; balancing ; the statements of account ; classes of ledger accounts. Interpretation of ledger accounts. Recording of transactions relating to bills of exchange ; accommodation bills. The Trial Balance : its extraction, uses and limitations ; suspense accounts. The division of the ledger ; the construction and importance of control accounts.

(d) **The Cash Book** : Use of analysis columns ; petty cash book ; bank reconciliation statement. Treatment of bank current account, bank deposit account, bank overdraft, bank loan, and other loans.

**3. The accounts of sole traders and partnerships**

(a) *The trading and Profit and Loss Accounts of both.*

(i) The nature of profit (or loss) and its ascertainment for a specified period from the records : net profit (or loss) as the increase (or decrease) in the net value of assets *during that period*. Gross and net profits and their relation to valuation of stock, to rate of stock turn, to turnover, expenses and capital. Simple columnar trading account when dealing with departments.

(ii) Treatment of payments in advance and of amounts due but unpaid : incomes received in advance and incomes earned but not received. Techniques and methods of treating depreciation in accounts : the fixed instalment system ; machine hour rate system ; depletion unit system ; revaluation system ; reducing balance method. Provisions for bad and doubtful debts, discounts and other contingencies. Treatment of ancillary income.

(b) *Partnership* : The capital and current accounts of partners, the appropriation of profits ; necessary entries on admission, retire-



## *Elective Subjects*

ment, death of a partner, dissolution of a partnership firm ; methods of setting out in the Balance Sheet partners' capital and profit allocations.

### **Paper 2 : (3 hours)**

**1. The accounts of a non-trading concern :** Receipts and Payments Accounts: Income and Expenditure Account and its preparation from receipts and payments account ; the Balance Sheet. Calculation and use of the average due date. Accounts relating to consignments and joint ventures.

### **2. The accounts of sole traders and partnerships**

(a) Purchase of a business by either a sole trader or a partnership including the calculation and recording of a goodwill.

(b) *The Balance Sheet* : A statement of balances on a specified day of a sole trader and partnership firm ; structure and interpretation ; significance of the inter-relationship of its items. The meaning of Capital. Valuation of assets. The meaning, importance and designation in the balance sheet of fixed assets, current assets current liabilities, working capital, long-term liabilities. Meaning and importance of wasting assets and fictitious assets. The difference between capital as shown in the records and the capital employed.

### **3. Special forms of accounts**

(a) Simple Manufacturing or Production Account for ascertainment of direct and indirect cost (prime cost and overheads).

(b) Incomplete records : ascertainment of gross and net profits : calculation of total credit sales and purchases.

**4. The Accounts of Joint Stock Companies.** The syllabus is limited to the following : the Appropriation Account in a simplified form ; the capital structure of a joint stock company and how it appears in the balance sheet. Basic knowledge of the distinction between nominal, authorised, called-up, issued and paid-up capital and between share capital—preference, ordinary, deferred—and loan capital (e.g. debentures.) Recording of the issue (including forfeiture and reissue) of shares and debentures.

## OFFICE PRACTICE (859)

### Aims :

The syllabus has been designed to encourage an interest in general office functions and systems and more particularly,

- (i) to develop an awareness of their significance related to general education and office skills ;
- (ii) to provide a knowledge of the main tasks of office staff ;
- (iii) to enable a knowledge deriving from this study to be applied in a practical way ;
- (iv) to develop the practice of communication through the clear expression of ideas and of comprehension of written material and instructions.

There will be *two* papers as follows :

**Paper 1 :** Organisation and Procedures (3 hours) will consist of short-answer questions and may contain essay-type questions.

**Paper 2 :** Communication (3 hours) will contain essay-type questions

### **Paper 1 : ORGANISATION AND PROCEDURES.**

#### (a) *The World of Business.*

Large and small firms : departmental structure ; the function of the office ; kinds of office work ; applying for a post ; interviews.

#### (b) *Manpower.*

- (i) Organisation of manpower—its importance, recruitment, selection and training.
- (ii) Motivation—reward—responsibility—satisfaction—achievement—leadership.
- (iii) Structures and hierarchy—line of staff—the importance of team work—centralization and decentralization—methods of management.

## *Elective Subjects*

### **(c) *Mailroom Procedure.***

- (i) Incoming mail—receipt and distribution ; need for care and promptness in distribution : importance of enclosures : dealing with remittances ; date stamping.
- (ii) Outgoing mail—the preparation and despatch. Postal Services.
- (iii) Mechanical aids, e.g. letter-opening machines, franking machines, etc.

### **(d) *Classification of information***

Listing, filing and indexing—its importance and the principal methods : systems and equipment. Microfilming.

### **(e) *Reprographic Processes.***

Carbons, NCR (no carbon required) paper, office copying machines, spirit and ink duplicators, offset litho.

### **(f) *Office Records.***

- (i) Wage records—methods of payment : deductions from wages—Provident Fund and Pension Scheme—PAYE (pay as you earn e.g. income tax). Coin and note summaries.
- (ii) Stock records.
- (iii) Simple documents and terms used in connection with buying and selling.
- (iv) Petty cash.
- (v) Postage book.
- (vi) Graphs and charts.
- (vii) Adding and calculating machines ; punched cards.

### **(g) *Banking.***

The services provided by the Banks and the Post Office for settling debts. The use of current accounts. Further services of the Post Office, e.g., licences.

## **Paper 2 : COMMUNICATION.**

- (i) Personal contact, reception of visitors ; telephone services. The office switchboard—internal and external systems. Rules for the efficient use of the telephone ; recording messages.

- (ii) Effective writing, letters : mode of address, addressing envelopes : memoranda : circulars ; telegrams.
- (iii) The preparation and presentation of summaries from given information, e.g. drafting a report from given data or sources of information.
- (iv) The preparation and presentation of tasks associated with meetings; e.g. notices, agenda (including resolutions), minutes, reports.
- (v) The preparation and presentation of tasks associated with travel; e.g. preparation of itinerary.
- (vi) Tabulation. Tables of various types. Financial statements. Extraction of information from these. Translation of material into tabular form.
- (vii) Display. Advertisements : notices : menus : programmes ; invitations and replies.
- (viii) Designing forms, e.g. application forms ; forms of supplying specific information.
- (ix) Rearrangement of lists of names, addresses, etc., into alphabetic, geographic order, etc.

## MATHEMATICS (360)

TO :

To develop :

1. A sufficient logical sense ; this includes the power to draw deductions, understand the meaning of symbols, perceive relevance, see the general lines of an investigation apart from its details, and realize the distinction between hypothesis and fact.
2. Accuracy and reasonable facility in algebraic manipulation.
3. The power to think in generalities as well as particularities, e.g., **to see** that if  $x$  steadily decreases,  $1/x$  must steadily increase ; an **important** application is to the *sketching* of graphs of simple functions.
4. **Knowledge** of various ideas, theorems, and processes.

The course contains no explicit reference to Arithmetic or Pure Geometry, but a knowledge of these subjects is, of course, assumed. The parts of Geometry which are of chief importance in other branches of Mathematics are the fundamentals concerning angles, parallels (including lines and planes in space), similar triangles (including the theorem of Pythagoras) the "symmetry" properties of chords and tangents of a circle, and the theorem that a line perpendicular to two non-parallel lines in a plane is perpendicular to every line therein. The examination may include questions with a geometrical content.

As regards the standard of algebraic manipulation, students should be taught (i) to check every step before proceeding to the next particularly where minus signs are involved; (ii) to attack simplification piecemeal rather than *en block* e.g., never to keep a common factor which can be cancelled; (iii) to observe, and act on, any special features of algebraic form that may be obviously present. The standard as regards (iii) is difficult to define; initial practice should be on the easiest cases, "trick" examples should be avoided, and it should be kept in mind that (iii) is subsidiary in importance to (i) and (ii). Teachers should be scrupulous in setting a standard of neatness and in avoiding the slovenly habit of omitting brackets or replacing them by dots.

There will be *two* papers of *three* hours each as follows :

**Paper 1** (3 hours). Pure Mathematics (ten questions).

*Candidates will be required to answer eight questions.*

**Paper 2** (3 hours). The paper will be divided into *four* sections:

Section A will contain *four* questions on Mechanics, Section B will

contain *four* questions on Higher Analysis and Differential Equations.

Section C will contain *four* questions on Statistics and Section D will

contain *four* questions on Vectors and Algebraic Structure.

*Candidates will be required to answer six questions in all choosing two questions from EITHER Section A OR Section B, two questions from Section C and two questions from Section D.*

Slide rules may be used.

### **Paper 1**

Indices, logarithms and surds. Remainder and factor theorems.

Elementary sequences : sum of a finite number of terms in the case of an Arithmetical Progression and of a finite and infinite number of terms in the case of a Geometrical Progression (including the formula for  $t_n$  and  $S_n$  in both cases).

Elementary permutations and combinations. The binomial theorem for any index, (integral or fractional + ve or - ve), and its use for simple approximations. (Questions on the greatest term and on properties of the coefficients will not be asked).

Elementary theory of quadratic equations.

Circular measure ; arc length and area of a sector of a circle. Trigonometrical ratios angles of any magnitude.

Graphs of simple trigonometrical functions. The solution of triangles and determination of area (only the sine and cosine formulae and the formula  $\frac{1}{2} bc \sin A$  will be needed).

Simple trigonometrical problems in three dimensions.

Use of formulae for  $\sin(A \pm B)$  ;  $\cos(A \pm B)$ ,  $\tan(A \pm B)$  : applications to multiple angles and simple identities. Solution of trigonometric equations.

Ideas of functions and relations ; cartesian graphs by sketching and accurate plotting ; arrow diagrams ; domain and range of a function.. Composite functions (Notations such as  $y = f(x) = \sin x$  and  $f : x \rightarrow \sin x$  should be used). Range of values of the function  $ax^2 + bx + c$  by graphical and other methods.

## ***Elective Subjects***

***Co-ordinate geometry in two dimensions*** ; gradient of a straight line and angle between two straight lines and the relationship between gradient of perpendicular lines and parallel lines. Equation of a straight line in its various forms. Determination of a function from a straight line graph ; distance formula ; distance of a point from a line. Equation to a circle ; equation of tangent and normal to a circle. Equation to a curve by means of parametric equations : equations of tangent and normal. Elementary locus problem involving elimination of a parameter. Definition of conics by foci and directrix : Equation of conics and determination of their standard formulae.

***Co-ordinate geometry in three dimensions*** : Distance between points ; equations of a plane : distance of a point from a plane. Equation of a sphere. Formulations of equations of a plane and a sphere from simple data.

Limits of a function of a real variable of the form  $f(x)$  and  $f(x)/g(x)$  where  $f(x)$  and  $g(x)$  are polynomial functions. The meaning of  $\frac{dy}{dx}$ . Elementary theorem on limits (intuitive approach only).

Derivatives of simple algebraic and trigonometrical functions including sums, products quotients. Use of derivatives to estimate small increments, rates of change, velocity and acceleration, maxima and minima. Differentiation of composite functions (excluding implicit and inverse trigonometrical functions, use of change of variable in differentiation). Use of integration in finding areas and volumes of revolution and to kinematics.

Integration as the inverse of differentiation. Integration of simple functions including use of a change of variable (excluding integration by parts). The definite integral.

Determinant as a function which maps a square matrix into a real number. Determinants of orders 2 and 3. Theorems on elementary transformations and their use in working with determinants. Solutions of linear equations in two variables. Consistency of three equations in two variables.

**Paper 2**

**Either Section A—Mechanics**

(While formal vector notation will not be used in question papers vector methods of solution will be welcome where appropriate).

Kinematics of a particle moving in a straight line; its graphical treatment ; motion with uniform acceleration.

Composition and resolution of velocities ; relative velocity.

Composition and resolution of forces : moments. Introduction to the theory of couples. An experimental basis is sufficient; proofs of the fundamental theorems of statics will not be required.) Equilibrium of a particle and of a rigid body under coplanar forces. The laws of friction between solids in contact.

Newton's laws of motion and the ideas of force, momentum, energy, work, power. The conservation of energy. Projectiles (range on horizontal plane only.)

**Or Section B—Higher Analysis and Differential Equations.**

The number  $e$  ; the graphs and derivatives of  $e^x$ ,  $a^x$ ,  $\ln x$  and  $\log x$

Complex numbers ; their geometric representation (not de Moivre's theorem).

Integration by parts ; use of partial fractions.

Formation of differential equations under easily understood situations.

Solution of differential equations of first order and first degree by separation of variables and of linear differential equations of first order i.e. the type  $\frac{dy}{dx} + Py = Q$  where  $P$  and  $Q$  are functions of  $x$ .

Application to kinematics.

Sketching of families of solution curves for simple differential equations.

**Section C—Statistics**

(Credit will be given for the choice and use of appropriate methods and for valid deductions from results, as well as for the ability to carry out mechanical processes. Proofs will not be required).



## Elective Subjects

The tabulation and appropriate representation of numerical data ; choice of class intervals.

Measures of central tendency : mean, median and mode. Percentiles. Estimation of median, quartiles and percentiles from the Ogive.

Measures of dispersion : interquartile range and standard deviation. Use of assumed mean.

Moving averages.

Index numbers.

The sum and product laws of probability. Expectation.

Discrete variable. Simple probability and frequency distributions, particularly the binominal distribution and its mean and standard deviation.

General ideas of sampling and surveys. Estimation of the limits of a mean of a population from a large sample.

Scatter diagrams. General ideas of correlation. Calculation of a rank correlation coefficient (preferably Kendall's).

### Section D—Vectors and Algebraic Structure

Displacement and position vectors (2 dimensions) : addition of vectors : multiplication of a vector by a scalar ; the ratio theorem

$$\lambda \mathbf{OP} + \mu \mathbf{OQ} = (\lambda + \mu) \mathbf{OR}.$$

The scalar product  $\mathbf{a} \cdot \mathbf{b}$  of two vectors in the form

$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}| |\mathbf{b}| \cos \theta$  and also  $\mathbf{a} \cdot \mathbf{b} = a_1 b_1 + a_2 b_2$  where

$$\mathbf{a} = \begin{pmatrix} a_1 \\ b_2 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \end{pmatrix}$$

application of the scalar product to test perpendicularity in a plane. Examples of arrays from everyday life : square and rectangular arrays ; components of a position vector as elements in a  $2 \times 1$  rectangular array. Row and column vectors.

(Use of the languages and notation of sets, including Venn diagrams, will be expected).

In question papers, vectors will be printed in Clarendon Type, and their magnitudes denoted by modulus signs, e.g.  $|\mathbf{AB}|$  ;  $\mathbf{a}$ ,  $|\mathbf{a}|$ .

In their answers, candidates are expected to indicate vectors in some definite way e.g. by an arrow or by underlining. Thus

$\rightarrow \rightarrow$   
AB a or AB, a or AB, a.)

Matrices as arrays obeying prescribed rules of operation ; addition rule ; null matrices ; multiplication rules ; unit matrices ; pre- and post-multiplication and the non-commutative property.  $m \times n$  matrices ( $m, n \leq 4$ ) over the real field.

The set of  $2 \times 2$  matrices ; inverse of a non-singular  $2 \times 2$  matrix ; geometrical interpretation of conditions for non-existence of an inverse. Matrix method for solution of simultaneous equations involving 2 variables.

Application of  $2 \times 2$  matrices to geometrical transformations of the plane ; combination of rotations, reflections, enlargements and shears.

The ideas of group, commutative field, and isomorphism ; illustrations from geometric patterns, permutations, the number system and residue classes to a prime modulus (finite field).

Finite and infinite abelian groups as algebraic structures ; uniqueness of identity, inverse, and solution of  $p \cdot x = q$ . Cancellation Law.

Boolean algebra as an algebraic structure. Simple application to logic and switching circuits.

## PHYSICS (861)

### Aims :

This syllabus is intended to indicate the scope of the course and not to indicate the teacher's approach to the subject. Its character results from an attempt to provide a course which is stimulating and worthwhile, both educationally and culturally, for the variety of candidates who study physics at this level. The course should be attractive and valuable to those who might take it with no expectation of using it later, as well as suitable for those for whom physics will form a major part of their studies at a university or technical college. The style of the syllabus represents a compromise between simply indicating the spirit of the course on the one hand and giving a detailed coverage of every topic on the other. While it may well be thought best to teach the subject "vertically", developing the hierarchy of ideas through each particular topic in turn, there is adequate opportunity for "horizontal" development, i.e. emphasis of the concepts which link across the topics, as the candidate's maturity allows. The course is successful if it imparts an increased understanding of, and fascination in, the things of the physical world around us, and if it develops the ability for thinking clearly.

The particular qualities which it is hoped that this physics course will promote may be summarized as follows :

- (a) knowledge of physical facts and terminology,
- (b) knowledge and understanding of physical principles,
- (c) the ability to understand and interpret scientific information presented in verbal, mathematical or graphical form and to translate such information from one form to another.
- (d) the ability to describe phenomena in terms of models, laws and principles,
- (e) the ability to formulate and perform relevant calculations,
- (f) the ability to test hypotheses and to use information to formulate hypotheses,
- (g) the ability to solve problems which are unfamiliar or presented in a novel manner,

- (h) the ability to design and perform good experiments,
- (i) confidence in using scientific equipment,
- (j) a critical attitude to information and ideas,
- (k) the ability to organise ideas and facts and to present them clearly.

The examination is designed as a test of these qualities. Questions dealing with qualitative aspects of physics will be included.

There will be *three* papers as follows :

**Paper 1** : (two hours) will consist of a number of compulsory structured short answer questions.

**Paper 2** : (three hours) will consist of long answer type questions. Candidates will be required to answer *six* questions : *three* from Section A, *one* each from Section B and C and *one* more from either Section B or Section C.

**Paper 3** : (three and a quarter hours). A practical examination.

The allocation of marks for the three papers will be as follows :

<b>Paper 1</b> : (Theory)	—70 marks
<b>Paper 2</b> : (Theory)	—90 marks
<b>Paper 3</b> : (Practical)	—40 marks

### DETAILED SYLLABUS

There are key concepts, such as energy, field, potential, waves, conserved quantities, which run “horizontally” throughout physics. These concepts do not, however, provide convenient headings for the subdivision of a syllabus. This syllabus is set out more in terms of its “vertical” structure, that is, the grouping of the items has more reference to the sequence of concepts on which the various areas depend. It is nevertheless hoped that the individual teacher will encourage his pupils to appreciate the way in which the key concepts permeate and unify the subject.

### SECTION A

#### 1. General Physics

*Units*, the *SI* system. Accuracy and approximation in expressing a measurement, significant figures. Power of ten and order of magnitude.

## Elective Subjects

*Dimensions*, and dimensional equations of mechanical quantities—area, volume, velocity, acceleration, momentum, force, moment of force, energy and work. Application to check formulae. Aids to measurement.

*Errors*, simple treatment.

*Vector and scalar quantities*. Addition and resolution of vectors, scalar (dot) and vector (cross) products, moments and couples, conditions of equilibrium of a rigid body acted on by coplanar forces.

*Dynamics*. Newton's laws; mass, force and acceleration. Momentum, work, potential energy, kinetic energy and power. Conservation of momentum and energy. Elastic and inelastic collisions in one dimension only (coefficient of restitution not required). Friction as a force opposing relative motion; sliding and rolling friction. Motion in fluids; viscous drag, Stoke's law (derivation not required), terminal velocity, streamline flow, turbulence. Bernoulli's principle with examples.

*Circular motion*. Moments and couples. Centripetal forces and accelerations. Moments of inertia as  $I = T/\dot{\theta} = \Sigma mr^2$ , radius of gyration, (derivations, and experimental determination, of moment of inertia *not* required). Conservation of angular momentum.

*Gravitation*. Newton's law of gravitation, gravitational constant  $G$  (determination *not* required), relation between  $G$  and  $g$ . Gravitational field and potential. Centre of gravity. Circular orbits, periodic time of a satellite. Speed of escape.

*Kinetic theory*. Evidence for belief in molecules. Microscopic model of ideal gas and derivation of  $p = \frac{1}{3}nm\overline{c^2} = \frac{1}{3}\rho c^2$  leading to  $pV_m = \frac{1}{3}Mc^2 = RT$ .

*Interatomic forces*. The form of interatomic force and potential curves for two atoms: equilibrium distance, dissociation energy; condensed states of matter. The liquid state, surface tension capillary rise, and angle of contact (details of measuring angle of contact not required). Elasticity of solids: Young's modulus, bulk modulus and modulus of rigidity. Hooke's law as linear approximation for small displacements. Determination of Young's modulus; work done in extension.

## 2. Oscillations and Waves

*Simple harmonic motion.* Time displacement graph  $y = y_0 \sin(\omega t + \phi)$ , phase angle. Amplitude, frequency and angular frequency. Simple pendulum, time period (derivation *not* required), determination of  $g$ . Free, damped and forced oscillations treated qualitatively (graphs and demonstrations using mechanical and electrical illustrations) with reference to resonance.

*Waves.* Nature of motion in transverse and longitudinal, progressive and stationary waves; nodes and antinodes. Relation between speed, wavelength and frequency. Intensity and amplitude. Superposition, interference and beats. Sound as wave motion; determination of speed and frequency; harmonics, quality of sound. Laws of stretched-strings. Modes of vibration of strings and air columns; resonance. Doppler effect.

*Electromagnetic waves.* The complete electromagnetic spectrum from radio waves to gamma rays; Ultra violet and infra-red radiations. A method of direct determination of  $c$ . Conditions for interference; interference by double slit and in thin films (for monochromatic source). Fraunhofer diffraction; simple treatment of plane transmission grating, measurement of wavelengths. Plane polarised e.m. waves (elementary idea). Refraction and its explanation in terms of speeds; refractive index, Snell's law, refraction through a prism, minimum deviation, dispersion. Critical angle; total internal reflection. Thin lenses; relation between  $u$ ,  $v$ ,  $f$ ,  $r$  and  $\mu$ . Spherical aberration and parabolic mirrors. Thin lenses in contact; chromatic aberration; achromatic combination. Simple astronomical telescope (refracting and reflecting) and compound microscope in normal adjustment. Magnifying power of a single lens, astronomical telescope and microscope. Spectrometer as collimator and telescope; setting and use.

## 3. Thermal Physics

*Temperature.* Idea of thermal equilibrium, Zeroth law, temperature. Empirical scales of temperature. Gas, liquid, resistance and thermoelectric thermometers. Boyle's and Charles laws; Dalton's law of partial pressures; absolute temperature; the gas equation  $pV_m = RT$ .

## Elective Subjects

**Internal energy.** The first law of thermodynamics. The joule as the common unit of work and heat. Specific heat capacity. Isothermal and adiabatic changes in : perfect gas, described in terms of  $p - V$  curves for  $pV = \text{constant}$  and  $pV^\gamma = \text{constant}$  (derivation of, and calculations based on  $pV^\gamma = \text{constant}$  will *not* be set). Work done in expansion; principal molar heat capacities;  $C_{p,m} - C_{v,m} = R$ .

Expansion of solids and liquids; thermal conductivity.

Change of state and origin of latent heats; principle of their determination. Vapour pressure, saturated vapour pressure.

**Thermal radiation** as a form of energy, principles of thermopile and bolometer. Prevost's theory of exchanges. Qualitative effect of nature of surface on energy absorbed or emitted by it; black body radiation. Stefan's law, Wien's displacement law (proofs *not* required) Distribution of energy in spectrum of black body radiation (only qualitative graphical treatment).

## SECTION B

### 4. Electromagnetism

(1) **Magnetism.** Magnetic dipole; torque on a magnet in a magnetic field ; magnetic moment ; field due to a magnetic dipole (end-on and broadside position) ; atomic model of magnetism. Superposition of magnetic fields ; tangent law ; deflection and vibration magnetometers. Properties of dia, para and ferro-magnetic substances. The existence and effects of magnetic hysteresis (experimental plotting of hysteresis loops is *not* required).

(2) **Electrostatics.** Coulomb's law (experimental verification *not* required), permittivity of free space. Concept of electric field,  $E = F/Q$ . Electric potential;  $E_x = -dV/dx$ . Permittivity and relative permittivity of a dielectric medium,  $\epsilon = \epsilon_0 \epsilon_r$ .  $E$  and  $V$  near point charges. Electric dipole;  $E$  and  $V$  at end-on and broadside-on positions. Capacitance,  $C = Q/V$ , the farad. Energy of charged capacitor,  $\frac{1}{2}CV^2$ . Capacitors connected in series and parallel. Capacitance of spherical conductor, and parallel plate capacitor.

(3) **Steady currents, Sources of current.** Force between current carrying conductors; the ampere. Electrons as current carriers in metals. Current in gases and solutions, electrons and ions as charge carriers. Potential difference as power supplied/current. The coulomb.

Ohm's law, change of resistance with temperature. Heating effect of current and power. Electromotive force of a cell, internal resistance, back e.m.f., accumulator; Kirchhoff laws; Wheatstone bridge; metre bridge; potentiometer; use of standard resistors and standard cells. Internal resistance of sources of current. Use of shunts and series resistors in ammeters and voltmeters.

(4) *Electromagnetics*. Magnetic flux density defined by  $B = F/I \sin\theta$ . Hence force on moving charge in a magnetic field. Couple on rectangular coil in uniform field; the moving coil galvanometer. Biot-Savart law, field near a long straight wire, at centre of circular coil, inside a solenoid. Magnetic flux,  $\psi = BA$ . Induced e.m.f.; Faraday's and Lenz's laws; eddy currents. Mutual and self inductance, the henry. Simple a.c. and d.c. generators, simple d.c. motors and back e.m.f. in d.c. motors.

(5) *Alternating currents*. Change of voltage and current with time, the phase difference (treatment in terms of oscillograms). R.M.S. and peak values; their relation in the sinusoidal case. Alternating e.m.f.'s applied to resistors, capacitors and inductors separately, vector representation in each case; phase lag and lead. Impedance,  $I_{\text{RMS}} = E_{\text{RMS}}/Z$ ; impedance of LCR circuit,  $Z = \sqrt{R^2 + (\omega L - 1/\omega C)^2}$  arrived at by vector diagram, resonance frequency. Ideal transformer.

## SECTION C

### 5. Microscopic Physics

*Electrons*: Measurement of  $e$  by Millikan's method or a similar method. The electronvolt as a unit of energy.

Principle of cathode ray oscillograph; measurement of  $e/m$  for electrons. The wave-particle duality, the phenomenon of electron diffraction (informative *only*, derivations and determination of Planck's constant *not* required).

$E/M$  for positive ions. Principle of mass spectrograph.

*Photoelectric effect*. Quantization of radiation; Einstein's equation; threshold frequency, the work function; energy and momentum of photon; the photoelectric cell.

*Atomic structure and origin of spectrum*. Charge and size of nucleus, evidence from alpha particle scattering.



## *Elective Subjects*

Bohr's postulates; emission and absorption spectra explained in terms of energy level diagram (derivations *not* required). Spectral series of hydrogen. Line, band and continuous spectrum. Fraunhofer lines. Production of X-rays; maximum frequency for given tube potential.

*Nucleus.* Neutrons and protons.  $E = mc^2$ , mass excess and nuclear binding energy. Charge and mass of nuclei. Atomic number, relative atomic mass, isotopes.

*Radioactivity.* Random nature and half-life. Nature and properties of alpha, beta and gamma rays; operation of cloud chamber and G-M tube. An outline treatment of the biological effects of ionising radiation; safety precautions. Nuclear reactions; change in atomic number and mass number in simple reactions and in radioactive decay. Artificial radio-activity, radio-isotopes; uses of tracers in medicine, industry and agriculture.

*Nuclear energy.* Energy and mass changes, nuclear energy. Working principle of cyclotron. Fission and fusion; principle of nuclear reactor, chain reaction, sun's energy (detailed nuclear reactions *not* required)

*Electronic devices.* Thermionic emission; vacuum diode as rectifier; triode characteristic curves and definition of plate resistance, amplification factor and mutual conductance, its function as an amplifier. Elementary idea of intrinsic and extrinsic semiconductors, p-type and n-type semiconductors. Junction diode as rectifier, npn or pnp transistor as common emitter amplifier (only circuit diagrams and qualitative treatment)

### **Practical Examination**

The object of the practical examination is to test whether candidates have worked through a satisfactory course in the laboratory and are capable of handling simple apparatus.

Three questions will be set; candidates will be required to answer **Question 1** and one of the remaining questions.

The questions will, unless they are of a routine character, contain detailed instructions for all the operations to be performed.

The examiners will not be strictly bound by the syllabus in

Setting experiments ; where necessary, candidates will be told exactly what to do, only knowledge of theory within the syllabus being demanded.

Questions may be set which involve measurements with a vernier or a screw gauge.

Candidates should be trained to take as varied a set of readings as possible, and to set out the actual observed readings systematically on one of the sheets of paper sent up. The experiments may require tabulation of results graphically.

Candidates *may* be examined in any of the experiments given below. It is, therefore, not necessary to mark any exercises compulsory.

1. Use of the slide rule.
2. Simple pendulum and its laws, determination of 'g'.
3. Measurements of the coefficients of friction.
4. Study of the properties of an inclined plane.
5. Study of the properties of various systems of pulleys.
6. Hooke's law and its applications, including the determinations of Young's modulus.
7. Verification of Boyle's law for gases.
8. Use of a travelling microscope, surface tension measurements.
9. Calibration of the bore of a tube.
10. Cubical expansion of liquid (sp. gr. bottle).
11. Constant volume air-thermometer.
12. Determination of the dew point and the relative humidity of the atmosphere.
13. Specific heat by the method of cooling (law of radiation).
14. Determination of J by an electrical method with correction for heat loss (Half-period method).
15. Frequency of a tuning fork by resonance.
16. Frequency of a tuning fork by using a sonometer.
17. Melde's experiment.
18. Magnifying power of a microscope.
19. Magnifying power of a telescope.
20. Use of a spectrometer for measuring refractive index.
21. Magnetic moment of a bar magnet and determination of H.

### ***Elective Subjects***

22. Use of tangent galvanometer (Determination of H).
23. Use of a Wheatstone's bridge for measuring an unknown resistance.
24. Measurement of the resistance of a galvanometer by Kelvin's method.
25. Measurement of the resistance of a cell by Mance's method.
26. Measurement of a low resistance by the fall of potential method.
27. Comparison of e.m.f. using a potentiometer.
28. Use of a copper voltameter.
29. Measurement of electrical energy consumed in a circuit.
30. Measurement of dip by a dip-circle.
31. Coefficient of volume expansion of a gas (Capillary tube method).
32. Focal length of a concave lens by auxiliary lens (not in contact).
33. Refractive index of a lens by Boy's method.

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### ***MATHEMATICAL NEEDS***

#### **Essential Requirements**

##### **ARITHMETIC AND ALGEBRA**

Candidates need to be able to do the following :

Make calculations involving addition, subtraction, multiplication and division of quantities expressed in decimal notation.

Make approximate evaluations of numerical expressions, using approximations such as  $\pi \approx 3$ .

Express small fractional changes as percentages, and vice versa.

Calculate an arithmetic mean.

Transform decimal notation to power of ten notation (standard form), and carry out calculations in standard form.

Use tables of squares, square roots, reciprocals, sines, cosines and tangents.

Multiply and divide using either logarithm tables or a slide rule, preferably both.

Change the subject of an equation. Most such equations involve only the simpler operations, but do include positive and negative indices and square roots.

Substitute physical quantities into physical equations using consistent units so as to calculate one quantity. Check the dimensional consistency of such equations.

Solve simple algebraic equations. Most are linear, but they include equations involving inverse and inverse square relationships and simultaneous equations.

Formulate simple algebraic equations as mathematical models of physical situations and identify failures of such models (applications include dynamics, electric circuits and kinetic theory).

Recognize the equivalent forms of the logarithms of each of  $ab$ ,  $a/b$ ,  $x^n$  and  $e^{kx}$ .

Recall and use in the context of error estimation and other simple applications the expansions to one term in  $x$  of numerical instances of the form  $(1 \pm x)^n$ , where  $n$  may be negative or fractional, but  $0 < x \ll 1$ . (Note  $\ll$  very much less than.)

Comprehend and use the symbols.

$$<, >, \ll, \gg, \approx, /, \propto$$

Test tabulated pairs of values for direct proportionality, by a graphical method, or by constancy of ratio.

#### GEOMETRY AND TRIGONOMETRY

Candidates need to be able to do the following :

Calculate areas of right angled and isosceles triangles, circumference and area of circles, areas and volumes of rectangular blocks, cylinders and spheres.

Identify simple shapes whose areas approximate to those of more complex shapes (mainly narrow triangles and areas of strips in integration).

Recognize applications of simple theorems : Pythagoras' theorem with application to the chord theorem for a diameter and a perpendicular chord, congruency and similarity of triangles, angle sum of triangle.

Understanding of the basic concepts of transformation geometry will be used.

## *Elective Subjects*

Use sines, cosines and tangents in problems ; recall or quickly calculate values at  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $90^\circ$ ,  $180^\circ$ .

Translate from degree to radian measure, and vice versa.

Use radian measure particularly in connection with trigonometric functions.

Recognize and sketch graphs of  $\sin \theta$ ,  $\cos \theta$ .

Recall  $\sin \theta \approx \theta$ ,  $\cos \theta \approx 1$ ,  $\tan \theta \approx \theta$  for small  $\theta$ .

Sketch graphs of harmonically varying quantities, e.g.

$A \sin(\omega t) + B \sin(2\omega t)$  or  $A \sin(\omega t + \pi/2) + B \sin(2\omega t + \pi/2)$

### VECTORS

Candidates need to be able to do the following :

Find the resultant of two vectors, recognizing situations where vector addition is appropriate.

Obtain expressions for components of vectors in perpendicular directions recognizing situations where vector resolution is appropriate.

### GRAPHS

Candidates need to be able to do the following :

Translate information between graphical, numerical, algebraic and verbal forms.

Select appropriate variables and scales for graph plotting.

Determine the slope and intercept of a linear graph, in physical units.

Choose by inspection a straight line which will serve as the 'least bad' linear model for a set of data presented graphically.

Recall the form  $y = mx + c$ .

Use logarithmic plots to test exponential and power law variations.

Sketch and recognize the forms of curves such that  $y \propto 1/x$ ,  $y \propto x^2$ ,  $y \propto 1/x^2$ .

Understand and use the slope of a tangent to a curve as a measure of rate of change.

Understand and use the area 'below' a curve where the area has physical significance.

## CALCULUS

Use natural logarithms in arithmetic calculations and algebraic manipulations of simple kinds.

Correctly combine absolute and fractional errors in simple error estimations.

Comprehend and use the notations :  $\equiv$  (identity),  $\Sigma$ ,  $\int$ ,  $d/dt$ ,  $d^2/dt^2$ ,  $\bar{x}$  (mean value),  $f(x)$ ,  $e^x$ ,  $\Delta x$  (finite increment),  $\delta x$  (small increment),  $\ln x$ ,  $\rightarrow 0$ ,  $\rightarrow \infty$ .

Use first and second derivatives in solving physical problems, usually involving only simple polynomials, trigonometric functions and the exponential function.

Construct equations of the form  $dy/dt = ky$  and  $d^2y/dt^2 = -k^2y$  as mathematical models of physical situations, and solve them in particular cases.

Comprehend the relationship between the derivative and the slope of a curve, including the features of maxima and minima.

Comprehend the relationship between the definite integral as the area 'below' a curve, and integration as the reverse of differentiation.

Recognize the forms of the integrals of  $x^n$ ,  $\sin\theta$ ,  $\cos\theta$ .

Recognize the expansions of  $\sin(A \pm B)$ ,  $\cos(A \pm B)$ ; and the identity  $\sin^2\theta + \cos^2\theta = 1$ .

Recognize the approximations  $e^x \approx (1+x)$  and  $\ln(1+x) \approx x$  for  $0 < x \ll 1$ .

## NUMERICAL CALCULATION

Be able to estimate errors in numerical work.

Comprehend how to handle numerical work so that significant figures are neither lost unnecessarily nor carried beyond what is justified.

Be able to estimate orders of magnitude, both in numerical work and from a knowledge of science.

## Elective Subjects

### Summary of key quantities

Candidates will be expected to be familiar with the following quantities, their symbols, their units and their interrelationship. They should also be able to carry out calculations and deal with questions involving them along the lines indicated in the detailed syllabus. The list should not be considered exhaustive.

Quantity	usual symbols	usual unit
<i>Base quantities</i>		
mass	$m$	kg
length	$l$	m
time	$t$	s
electric current	$I$	A
thermodynamic temperature	$T$	K
amount of substance	$n$	mol
temperature	$t, \theta$	$^{\circ}\text{C}$
area	$A, S$	$\text{m}^2$
volume	$V, v$	$\text{m}^3$
expansivity, linear	$\alpha$	$\text{K}^{-1}$
expansivity, cubic	$\beta$	$\text{K}^{-1}$
density	$\rho$	$\text{kg m}^{-3}$
velocity	$u, v, w, \dot{x}, \dots$	$\text{m s}^{-1}$
acceleration	$a, \ddot{x}, \dots$	$\text{m s}^{-2}$
acceleration of free fall	$g$	$\text{m s}^{-2}$
force	$F, \mathbf{F}$	N
work, energy	$W, E, U$	J
potential energy	$V, \Phi, E_p$	J
kinetic energy	$T, K, E_k$	J
power	$P$	W
torque	$T$	N m
pressure	$p$	Pa
momentum	$p, \mathbf{p}$	$\text{kg m s}^{-1}$
viscosity	$\eta$	Pa s
moment of inertia	$I$	$\text{kg m}^2$
angular velocity	$\omega, \Omega, \dot{\theta}$	$\text{rad s}^{-1}$
angular acceleration	$\dot{\omega}, \ddot{\theta}$	$\text{rad s}^{-2}$
angular momentum	$p_{\theta}, b, L$	$\text{kg m}^2 \text{rad s}^{-1}$

Quantity	usual symbols	usual unit
gravitational constant	$G$	$\text{N kg}^{-2} \text{m}^3$
gravitational field	$g$	$\text{N kg}^{-1} = \text{m s}^{-2}$
gravitational potential	$\Phi$	$\text{J kg}^{-1}$
period	$T$	s
frequency	$\nu, f$	Hz
angular frequency ( $2\pi\nu$ )	$\omega$	$\text{rad s}^{-1}$
wavelength	$\lambda$	m
refractive index	$n$	
speed of electromagnetic waves	$c$	$\text{m s}^{-1}$
Young modulus	$E$	Pa
bulk modulus	$K$	Pa
tension	$T$	N
normal stress	$\sigma$	Pa
shear stress	$\tau$	Pa
Planck constant	$h, \hbar (=h/2\pi)$	J s
work function	$\Phi$	V
critical Angle	$\theta_c$	$^\circ$ (degrees)
focal length	$f$	m
object distance	$u$	m
image distance	$v$	m
magnifying power	$M$	
electric charge	$Q$	C
electric potential	$V, \varphi$	V
electric potential difference	$V$	V
electromotive force	$E$	V
resistance	$R$	$\Omega$
resistivity	$\rho$	$\Omega \text{ m}$
conductance	$G$	$\text{S} = \Omega^{-1}$
conductivity	$\sigma$	$\text{S m}^{-1} = \Omega^{-1} \text{m}^{-1}$
current density	$J, j$	$\text{A m}^{-2}$
temperature coefficient of resistance	$\alpha$	$\text{K}^{-1}, (^\circ\text{C})^{-1}$
Magnetic flux density	$B$	T
Hall coefficient	$R_H$	$\text{m}^3 \text{C}^{-1}$
specific charge	$q$	$\text{C kg}^{-1}$



*Elective Subjects*

Quantity	usual symbols	usual unit
permeability	$\mu$	$\text{H m}^{-1}$
permeability of free space	$\mu_0$	$\text{H m}^{-1}$
relative permeability	$\mu_r$	
magnetic flux	$\Phi$	<b>Wb</b>
mutual inductance	$M, L_{12}$	<b>H</b>
self inductance	$L$	<b>H</b>
permittivity	$\epsilon$	$\text{F m}^{-1}$
permittivity of free space	$\epsilon_0$	$\text{F m}^{-1}$
relative permittivity	$\epsilon_r$	
electric field strength	$E$	$\text{V m}^{-1}$
capacitance	$C$	<b>F</b>
time constant	$\tau$	<b>s</b>
reactance	$X$	$\Omega$
impedance	$Z$	$\Omega$
power factor	$\cos \varphi$	
molar gas constant	$R$	$\text{J K}^{-1} \text{mol}^{-1}$
heat capacity	$C$	$\text{J K}^{-1}$
specific heat capacity	$c$	$\text{J K}^{-1} \text{kg}^{-1}$
molar heat capacity	$C_m$	$\text{J K}^{-1} \text{mol}^{-1}$
principal molar heat capacities	$C_{v,m}; C_{p,m}$	$\text{J K}^{-1} \text{mol}^{-1}$
ratio of principal heat capacities	$\gamma$	
thermal conductivity	$k, \lambda$	$\text{W m}^{-1} \text{K}^{-1}$
Stefan constant	$\sigma$	$\text{W m}^{-2} \text{K}^{-4}$
activity of radioactive source	$A$	$\text{s}^{-1}$
decay constant	$\lambda$	$\text{s}^{-1}$
half-life ( $\ln/2\lambda$ )	$T_{\frac{1}{2}}, t_{\frac{1}{2}}$	<b>s</b>
atomic mass	$m_a$	<b>kg</b>
relative atomic mass	$A_r$	
electron mass	$m_e$	<b>kg</b>
neutron mass	$m_n$	<b>kg</b>
proton mass	$m_p$	<b>kg</b>
unified atomic mass constant	$m_u$	<b>kg</b>
relative molecular mass	$M_r$	
molar mass	$M$	$\text{kg mol}^{-1}$

Quantity	usual symbols	usual unit
Boltzmann constant	$k$	$\text{J K}^{-1}$
surface tension	$\gamma, \sigma$	$\text{N m}^{-1}$
angle of contact	$\theta$	$^{\circ}$ (degrees)
number per unit volume	$n$	$\text{m}^{-3}$
latent heat	$L$	$\text{J}$
specific latent heat	$l$	$\text{J kg}^{-1}$
Avogadro constant	$L, N_{\text{A}}$	$\text{mol}^{-1}$

## CHEMISTRY (862)

### Aims :

1. To give the student a knowledge of the framework of the subject so that he will appreciate and understand the structure and changing of matter under conditions which we call chemical.
2. To make the student realize the possibilities and limitations of such a knowledge.
3. To make him aware of the effects this knowledge has on society and so prepare him for life in a technological age.
4. To inculcate a critical attitude with theoretical speculation based on experimental facts and subjects to change.
5. To develop the ability for precise formulation of thought.
6. To develop manipulative and experimental skill necessary in the investigation of the materials in his environment.

These aims are made operational through the Syllabus content, the teaching method (e.g. the use of models) and the assessment techniques, a summary of which follows.

### Introductory Notes

In studying Chemistry, it needs to be emphasized that man's interest in the subject is essentially a practical one ; to use or convert materials for his own purpose and to discover the most efficient methods of doing so. This function of the subject is then complementary to the logic of scientific method, i.e. observation (establishing facts or laws of experience ; theory ; prediction ; experiment ; new facts).

As understanding of the subject grows, it becomes possible to renew study of problems that were formerly not amenable. This is especially relevant in modern times since the advent of more advanced techniques means that more and more phenomena can be studied experimentally. This is not merely to aid potential graduates but to try to give some relevant understanding of a science to a greater number of people, especially in an age when the pace of research means that new ideas can have important social consequences within a lifetime or even a decade.

The understanding of Chemistry must depend on knowing a sufficient but minimal number of facts and their relation to the fundamental principles derived from them, with due emphasis on

modern concepts. The present syllabus is an attempt to realize this idea, with the underlying theme that Chemistry is a study of the ways in which energy is associated with mass, chemical structure and chemical reaction. This should help to establish the subject as a quantitative science.

The student should have a good grounding of elementary facts and principles, and it is intended that the syllabus should build on this foundation by introducing such facts or ideas as will develop the student's elementary knowledge towards fuller understanding of Modern Chemistry. The syllabus is, thus, firmly based on Atomic Theory. Since, also, it is the purpose of scientific theory to try to relate and make coherent apparently diverse phenomena, it is intended that the topics of Physical Chemistry should be fully illustrated by particular examples so as to emphasize both the characteristic features of the chemistry of the elements and their compounds and the importance of the principles involved.

In Organic Chemistry, in particular, the use of molecular models is to be encouraged. However, candidates should be taught to realise that such models, in common with other methods of (pictorial) representation, have limitations and are usually not intended to illustrate more than a few aspects of the whole.

The scope of the practical examination is indicated in the Practical Chemistry syllabus printed at the end of the theory syllabus.

There will be *three* papers as follows :

**Paper 1** (two hours) will consist of a number of compulsory structured short-answer questions.

**Paper 2** (three hours) will consist of traditional-type questions.

*Candidates will be required to answer six questions including at least one question from each of sections, A, B and C.*

**Paper 3** (three hours) A practical examination.

The allocation of marks for the three papers will be as follows

**Paper 1** (Theory) — 70 marks

**Paper 2** (Theory) — 90 marks

**Paper 3** (Practical) — 40 marks

## SECTION A

### 1. Atoms and Molecules.

- The concept of atoms having fixed properties in explaining the laws of chemical combination, indestructibility of matter, cons-

## *Elective Subjects*

tant proportion, multiple proportion and reciprocal proportions and simple numerical problems on them are required.

### 1.1 Chemical equivalent (eq.wt) and its usefulness in the following :

- (a) A.W. (atomic mass) = E.W. (eq wt) x Valency,
- (b) Faraday's Second law of Electrolysis,
- (c) Normality and Molarity concept in teaching Volumetric analysis,

Dulong Petit's laws and simple numerical problems based on the law. Atomic and isotopic weights, and a simple, non-mathematical treatment of their derivation by mass-spectrometry.

Questions will not be set on the experimental determination of chemical equivalents and atomic weights by classical methods.

$^{12}\text{C} = 12$  should be taken as standard and the reasons for the disuse of  $\text{H} = 1$  and  $\text{O} = 16$  as standard should be appreciated.

### 1.2 The determination of molecular weight.

The qualitative explanation of the fact that molecular weights as determined do not always correspond to formula weights. Calculations involving such anomalous molecular weights are not required.

See also Sections 7.1, 8 (d) (i) and 11 ;

- (a) For gases and/or volatile liquids, by methods involving gas densities.

- (i) Direct weighing (ii) Victor Meyer (iii) using  $PV = nRT$

- (b) For solutes.

- (i) Depression of freezing point.

Candidates will be required to know only the details of the four methods quoted in Section A, 1.2 (a) and (b) (i);

- (ii) Osmotic pressure, only the principles. no details, of an accurate method are required.

Simple numerical problems on different methods mentioned above for the determination of molecular weights are included.

### 1.3 Formulae and Stoichiometry.

- (a) Empirical formula,
- (b) Molecular formula,
- (c) Relation between empirical and molecular formula.

- (d) Determination of molecular formula from empirical formula.
- (e) Numerical problems based on equations.

## 2. Atomic structure.

2.1 Electrons, protons and neutrons as the fundamental particles of major importance in chemistry; their charges and relative masses.

2.2 (a) The nucleus of the atom: isotopes and mass number.

The detection of  $\alpha$  and  $\beta$ -particles and  $\gamma$ -rays; the nature of  $\alpha$  and  $\beta$ -particles; evidence from the experiments with photographic emulsions and cloud chambers and from the differences in penetrating ability to establish the nature of the rays should be mentioned and treated qualitatively, but detailed treatment is not intended; Rutherford's experiment. See also Section 10 of this syllabus.

(b) The relation between the convergence limit of the Lyman-series and the ionisation energy of the hydrogen atom should be appreciated. The concept of electronic energy levels should be developed from data available on ionisation energies of lighter atoms.

Quantum numbers and the Pauli exclusion principle to be included: For a systematic approach the following are included:

- (i) Rutherford's experiment,
- (ii) Bohr's atomic model,
- (iii) Simple concept of orbitals,
- (iv) Atomic spectra, (differences of continuous and discontinuous spectra),
- (v) Study of Hydrogen spectra (to show that electrons are situated at certain fixed distance energy levels and not distributed about the nucleus),
- (vi) Lyman-series, Balmer-series, Paschen-series, Brackett-series, and Pfund-series.

Convergence limit of Lyman-series and other series, and ionisation energy must be mentioned. Questions will not be set on the *last four* series.

(vii) The Pauli exclusion principle regarding the structure

## Elective Subjects

of the atom. Quantum numbers should be treated in detail. (Quantum numbers are very much related to energy levels, sub-energy levels and orbitals).

- (viii) The size, shape and orientation of orbitals must be mentioned to represent the electronic configuration of the atom (representation in terms of s, p and d orbitals) e.g.  $\text{Cl} = 2,8,7 = 1s^2, 2s^2, 2p_x^2, 2d_y^2, 2p_z^2, 3s^2, 3p^5$ .

(c) Atomic number and the charge on the nucleus.

### 3. The Periodic Table.

1	2											3	4	5	6	7
1 H																1 H
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I
55 Cs	56 Ba	57 — 71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At
87 Fr	88 Ra	89 — 103														
			57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb
			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No

See also Sections A, 4 and B, 9.

- (a) Atomic number as the basis for classification of the elements in the Periodic Table. Questions will not be set on the historical development of the Periodic Table.

- (b) Extra nuclear structure as the basis of periodicity. Some idea of the following :  
Ionisation potential, Electron affinity, Atomic radius, Atomic volume etc. must be given.  
The periodicity of electronic structure leading to the periodicity of chemical elements e.g. the relative ease of ionisation of the elements.
- (c) Periodicity of elements with reference to s, p, d and f block elements.

#### 4. Chemical bonding.

An appreciation of the dependence of the properties of solids, liquids and gases on formula weight and also on types of chemical bonding involved is expected.

See also sub-section A, 3 and B, 9.

- (a) Electrovalent bonds between ions.

Formation of electrovalent compounds must be mentioned in terms of energy change for an idea that the formation of electrovalent compounds is always associated with the liberation of energy. The relation between ionic bonding and the Periodic Table must be mentioned. Variable electrovalency and its causes.

- (b) Covalent bonds.

Concept of variable covalency, and reasons for an element showing variable covalency e.g. (chlorine exhibits a variable covalency of 1, 3, 5 and 7)

- (c) Co-ordinated and hydrogen bonds.

The relation of these two types of bonds and the influence of hydrogen bonding on physical properties.

- (d) Metallic bonding, Van der Waals forces, dipole effect.

**Note :** The dipole effect as a 'shifting of the electron cloud' of a covalent molecule; the fact that many molecules are neither 100% ionic nor 100% covalent should be appreciated; the 'lone pair' effect should be used to explain the formation of  $\text{NH}_4^+$  ion and the complex copper (II)—terramine ion. The points mentioned in item 4 (a) to (d) and in the notes should be used to explain the differences in melting points, boiling points, solvation effects, forma-



## Elective Subjects

tion of ions (especially in solution), acid/base properties and linked with item 3 (b) to predict the type of compounds a particular atom, X, may form. The concept of repulsion between electron pairs, treated qualitatively, should be used to describe the shapes of simple molecules with not more than four electron pairs around the central atom, e.g.  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{CH}_4$  molecules.

### II. State of matter Structure : and properties

5. Gases, liquids, solids.

5.1 The gas laws, kinetic theory treated qualitatively.

- (a)  $PV = nRT$  or  $PV = \left(\frac{W}{M}\right) RT$  and the application of this form of the equation for (i) the derivation of Boyle's and Charles' laws, and (ii) determining the molar masses of gases and vapour ; Dalton's law ; the Avogadro constant; the mole.

See also the note to Section A, 7.2.

- (b) Diffusion of gases and Graham's law of Diffusion with simple numerical problems on it.

5.2 Solids.

- (a) Lattice structure and spacing.

Generally, only the qualitative idea that the particles are situated at fixed points in a regular pattern is expected, but for the four examples quoted below a knowledge of the geometry (but not dimensions) of the actual lattice is required. It should, however, be appreciated that the individual particles may be atoms, molecules or ions.

It is expected that the topic should be studied keeping the following points in view :

- (i) Crystalline or amorphous substances,
  - (ii) Characteristics of crystalline solids,
  - (iii) Elements of crystal symmetry,
  - (iv) Unit cell and lattice points,
  - (v) Ionic ( $\text{NaCl}$ ), metallic ( $\text{Cu}$ ), Atomic (diamond and graphite).
- (b) Sodium chloride, copper, diamond and graphite as simple examples of lattice.

Reference should also be made to crystalline forms of the solid allotropes of sulphur. Lattices to be explained in terms of items 4(a) to (d).

6. Phase equilibria.

Enantiotropy and Monotropy are included.

Study of variation of vapour pressure of a pure liquid with temperature.

Boiling point. Steam distillation boiling point diagrams for liquid mixtures (including azeotropes). Fractional distillation. Freezing point diagrams for liquid mixtures forming simple eutectics.

Study of phase rule with its applications to (i) one component (ii) two component systems is expected.

6.1 Solubility of gases in liquids.

Henry's law (derivation not required); a qualitative explanation of Henry's law in terms of Le Chatelier's theorem and the kinetic theory.

6.2 Distribution of a solute between two solvents.

(a) Distribution law, Ether extraction.

The partition law (only applies when the solute is in the same molecular state in the two solutions), the effect of association of the solute is not required. Solution of liquid in liquid, miscible and immiscible liquids and methods of separation to be treated qualitatively : use of fractional distillation ; solution of solid in liquid, solubility curves, determination of solubility are included. The partition or distribution law for the distribution of a solid or liquid between two liquids is similar to Henry's law (deviations not to be considered). Ether extraction : its use in organic chemistry : it is more economical to use ether in portions (to be explained through numerical examples, using the distribution law with the condition that the solute is in the same molecular state in the two solutions). The use of re-crystallisation and fractional crystallisation in the laboratory and in industry.

(b) Chromatography.

This may include : (i) Column chromatography (ii) Thin-

## *Elective Subjects*

layer chromatography, (iii) Paper chromatography, and (iv) gas chromatography, a qualitative treatment only is needed with an indication of its use as an analytic tool.

- 6.3 Colloidal solutions: preparation and properties of colloids, both hydrophillic (e.g. starch or gelatin) and hydrophobic (e.g. S or  $As_2S_3$ ). Precipitation as evidence that colloidal particles are charged.

No treatment of gold number is required. The importance of the large surface area and absorption should also be appreciated.

7. Electrical properties of solutions.

- 7.1 Application of ionic theory.

- (a) Solubility product and the common ion effect.  
(b) Ostwald's dilution law ; ionic product of water,  
(c) pH ; (i) pH indicators, (ii) buffer solutions.

Calculations based on the above sub-sections are not required. Ionic equations should be used, where suitable. The law of chemical equilibrium, in terms of molar concentration will need to be first stated (from this law, the concept of the solubility product and ionic product for water can be established) ; common ion effect and its relation to the solubility product should be treated qualitatively without calculations ; the connections between solubility and solubility product and between solubility product and precipitation are to be emphasized in a qualitative manner ; Ostwald's dilution law applied to the case  $AB = A^+ + B^+$  should be deduced from the law of chemical equilibrium and the relation between the law and the strength of an acid should be treated qualitatively. The ideas in 7.1 (c) are to be used to explain, qualitatively, the connection between pH and e.m.f. of a galvanic cell, the concept of weak and strong acids and hydrolysis. The strength of an acid (especially weak acid) increases with dilution.

- 7.2 Electrolysis ; Faraday's laws of electrolysis.

The relationship between the Faraday and Avogadro constant and the charge on the electron,  $F = NAe$ , should be given though details of Millikan's experiment are not required.

Simple Voltaic cell and electrode potentials.

Electrode potentials :

- (i) Meaning of the electrode potential,
- (ii) factors affecting electrode potential,
- (iii) standard electrode potential,
- (iv) standard hydrogen electrode,
- (v) measurement of standard electrode potential,
- (vi) mechanism of current production in the Voltaic cell,
- (vii) explanation of the electrochemical series on the basis of electrical properties i.e. standard electrode potential, e.m.f. etc.

**III. Reaction Kinetics and Chemical Equilibria.**

8. Chemical kinetics.

- (a) Qualitative treatment of the dependence of reactions rates on (i) concentration of reactants, (ii) size of the particle, (iii) temperature, (iv) presence of a catalyst. The concept of energy barrier. (It is suggested that some experiments may be devised which may deal with the above mentioned factors).

- (b) Reversible reactions ; dynamic equilibrium.

- (c) Homogeneous and heterogeneous catalysis.

The presence of the catalyst allows a different mechanism to operate, i.e. a different (usually lower) energy barrier is involved.

- (d) The concept of equilibrium constants in terms of concentrations or partial pressure to indicate the composition of the equilibrium mixture. The following are examples :

- (i) the dissociation of dinitrogen tetroxide,
- (ii) hydrolysis of simple esters,
- (iii) the contact process for the manufacture of sulphuric acid,
- (iv) the synthesis of ammonia.

Reference should also be made to solubility product, Ostwald's dilution law, the ionic product of water (see sub-section 7.1) in terms of equilibrium constants.

## *Elective Subjects*

(e) Le Chatelier's principle.

Reference should be made to exothermic and endothermic reactions. It should also be emphasized that the change in the volume of an equilibrium constant with temperature demands a corresponding change in the composition of the equilibrium mixture. The scope of this section is already suggested in items 6 and 7.1. All treatment is to be qualitative.

(f) Chemical reactions and energies.

A qualitative treatment of the following is expected :

(i) Heat of combustion, (ii) heat of formation, (iii) heat of reaction, (iv) heat of neutralisation, (v) heat of solution.

Hess's law of constant heat summation and its verification, a simple method.

### SECTION B

#### IV. Inorganic Chemistry

9. (a) General survey of the elements H, C, N, O, F, Na, Mg, Al, Ca, Si, P, S, Cl, Br, I, Fe, Cu, Zn, Pb, and their simple familiar compounds.

The general survey should include :

- (i) Occurrence in nature,
- (ii) Physical state,
- (iii) Position in Periodic Table; and discussed on the basis of electronic configuration and relation with neighbouring elements. The resemblance and difference between elements in the same group,
- (iv) Type of bonding,
- (v) Nature of oxide, hydroxide, chloride, carbonate, nitrate, sulphate,
- (vi) Formation of hydride, nitride, and carbide. Action of water, air, acids and alkalis.
- (vii) Conversion of compounds. Important uses.

Rare earths—with special reference to Lanthanides and Actinides.

Rare gases—with special reference to Helium and Neon (an elementary idea only).

The survey should be based on the Periodic Table. For

silicon, treatment should be limited to (i) justifying its place in the period (Na to Cl), and (ii) illustrating the change of properties within a group, i.e. C, Si and P. Opportunity should also be taken to consider the group characteristics as shown by (1) the Halogens and (2) the pairs of elements Na/K, Mg/Ca, C/S. Reference should be made to the location of Fe, Cu, Zn in the Periodic Table. Oxidation and reduction should be discussed in terms of electron transfer. See also sub-sections 1 to 4.

Silicon, silicates, silicones, semiconductors. Elementary idea of complex compounds. Co-ordination of amines with metals.

- (b) Laboratory preparations of the important compounds of the above mentioned elements and the manufacture (without technical details) of the compounds and elements used on a large scale e.g.  $\text{SO}_2$ , Na, NaOH, CO, P, Cl, O, Br, water-gas, producer-gas, Fe, Cu, Al etc.
  - (c) Manufacture of steels, some recent methods, namely, the electric furnace and LD-AC (Linz-Donau) or basic oxygen converter to be dealt with.
10. (a) A simple treatment of nuclear fission, e.g. a typical example of the first stage of the fission  $^{235}\text{U}$ . Nuclear equations are required. The general characteristics of nuclear fission (i) release of large amounts of energy, (ii) the production of lighter nuclei (also radioactive) and other fragments such as helium nuclei and neutrons, is expected.
- (b) Applications and uses of radio-isotopes such as  $^{14}\text{C}$  or  $^{32}\text{P}$ . An indication only of the principles of producing radio-isotopes by bombardment is required. The concept of 'half-life' period is to be appreciated. See also sub-section 2.

## SECTION C

### V. Organic Chemistry

11. The calculation of empirical and molecular formulae using composition by weight. See also Section A, 1.2

## Elective Subjects

12. A study of the characteristic properties and reactions of  $C = C$ ,  $C - Hal$ ,  $C - OH$ ,  $C = O$  and  $CHO$ ,  $COOH$ ,  $C - NH_2$ ; illustrated by reference by typical compounds such as : methane, methanol, ethylene, bromoethane, ethanol, acetaldehyde, acetylene, acetone, acetic acid, ethyl acetate, ethylamine, acetamide, urea, benzene, phenol, aniline, chloroform, chloroethane, formic acid, oxalic acid, glycerol, benzoic acid, glycine, glucose, Optical activity,  $SN^1$ ,  $SN^2$  reactions, elimination reactions.

Aldol condensation, Meer Ween-pondorff-verely reduction (questions may not be set on this topic), Cannizzaro reactions. Hofmann reaction. It is expected that basic ideas of reaction mechanism are given.

The laboratory preparation and where appropriate, the large scale preparation of the following :

Ethylene, acetylene, methyl alcohol, Grignard's reagent, with reference to aldehydes, ketones, amines and acids, acetic acid (vinegar), soaps. Details of purification of these named compounds are not required but the general chemistry of one preparative reaction for each class of compound should be known. The study of a particular compound should also include reference to its aliphatic or aromatic characters.

Large scale preparation, properties and uses of compounds like  $CH_4$ ,  $C_2H_6$ ,  $C_2H_2$  is included.

- 12.2 Laboratory preparation or other appropriate methods of preparation, properties and uses of the following :

- (a) ethyl-bromide, diethyl ether, formaldehyde, acetaldehyde, acetone, formic acid, acetyl-chloride, ester ethyl-acetate, ethylamine, chloro-benzene, phenol benzoic acid, nitro-benzene, aniline.
- (b) Acetic-anhydride, acetamide, urea (ammoniacal and potassium cyanate method), oil, soap, wax, carbohydrate. Under the carbohydrate, the following are included ;
  - (i) Monosaccharides-glucose and fructose,
  - (ii) Disaccharides-sucrose,
  - (iii) Polysaccharide-starch, cellulose, rayon.

- (c) **Optical activity** should be discussed on the following points :
- (i) meaning of optical isomerism,
  - (ii) dexo and laevo rotatory substances,
  - (iii) use of polarimeter
  - (iv) asymmetric carbon atom and Enantiomorphous,
  - (v) optical isomers of lactic and tartaric acids

13. (a) Homologous series, structural isomerism.  
 (b) The principle of addition and condensation polymerisation, illustrated by reference to natural and synthetic polymers, e.g. proteins, polyolefines and synthetic fibres.  
 Reference should also be made to the effect of chain length and cross linking on physical properties of polymers.

### PRACTICAL SYLLABUS

14. Candidates will be required to carry out specified tests and to make deductions from their observations.

Qualitative Analysis: They should be able to identify the following ions :

*Cations* :  $\text{NH}_4^+$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ca}^+$ ,  $\text{Ag}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Pb}^{2+}$

*Anions* :  $\text{CO}_3^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{CH}_3\text{COO}^-$

A formal group analysis is recommended for the identification of cations as substances supplied for analysis may contain a mixture of two cations.

For the interfering anion, a formal procedure of its elimination is expected.

15. (a) Candidates will be required, having been given full instructions, to carry out a simple *physico-chemical experiment* such as :
- (i) measurement of a rate of reaction (depending upon the size of the particle, concentration of reactants, temperature and presence of a catalyst), e.g.
    - (1) the study of the rate of dissolution of magnesium or zinc in dilute hydrochloric or sulphuric acid,
    - (2) decomposition of hydrogen peroxide solution in presence of a catalyst.



## Elective Subjects

- (3) liberation of iodine using sodium thiosulphate solution, etc.,
  - (4) measurement of heat combustion of methyl and ethyl alcohol,
  - (5) heat of neutralisation of acid and alkali (e.g. NaOH and HCl, etc.).
  - (6) preparation of Yamada universal indicator and its use.
  - (7) verification of Freundlich isotherm in the absorption of (1) benzoic acid, (2) acetic acid by activated charcoal by titration with 0.1N sodium-hydroxide solution. Such experiments will depend on simple manipulation of usual laboratory apparatus and may require the candidates to carry out simple titrations where necessary.
- (b) *Oxidation-reduction titrations* such as :
- (i) Iodine/sodium thiosulphate titration,
  - (ii) Potassium manganate (VII)/ammonium Iron (ii) sulphate titration,
  - (iii) Potassium manganate (VII)/oxalic acid titration,
  - (iv) Potassium dichromate/sodium thiosulphate titration,
  - (v) determination of the percentage purity of a compound in an impure sample,
  - (vi) determination of the number of molecules of water of crystallisation in hydrated copper (II) sulphate or hydrated Iron(II) sulphate, etc.

In such titrations, sufficient working details, including recognition of the end-point will be given.

- (c) Verification of Hess's law (by preparing NaCl solution in two different ways and measuring the heat evolved).
- (d) Simple and easy preparations of typical colloids such as (i) colloidal Iron (III)-chloride, (ii) colloidal sulphur, (iii)  $As_2S_3$ , etc.
- (e) *Gravimetric experiments* based on precipitation, such as :
  - (i) estimation of iron in hydrated ammonium iron (II) sulphate,
  - (ii) aluminium in hydrated aluminium sulphate,

- (iii) sulphate-ion ( $\text{SO}_4^{2-}$ ) in hydrated sodium sulphate,
  - (iv) magnesium in hydrated magnesium sulphate,
  - (v) calcium in calcium carbonate,
  - (vi) estimation of tin in solder, etc.
- (f) Identification of reactions involving the following organic compounds :
- (i) formaldehyde,
  - (ii) ethanol,
  - (iii) acetic acid,
  - (iv) acetone,
  - (v) glycerol,
  - (vi) glucose.

**Aromatic group**

- (i) Benzene,
  - (ii) Phenol,
  - (iii) Aniline.
- (g) Determination of the heat of reaction of
- (i)  $\text{CuSO}_4 + \text{Zn} = \text{ZnSO}_4 + \text{Cu}$
  - (ii)  $\text{CuSO}_4 + \text{Fe} = \text{FeSO}_4 + \text{Cu}$
- (h) Construction of simple Voltaic cell and Daniel cell and measuring their e.m.f.
- (i) Testing of food materials for adulteration, which may include :
- (1) Pure ghee (mixed with Vanaspati ghee or animal fat).
  - (2) Butter (mixed with starch or Vanaspati ghee),
  - (3) Turmeric (haldi, mixed with starch and colouring matter like lead-chromate etc.
  - (4) Milk (either fat is removed or water is added. In some cases starch is also mixed).
  - (5) Sweets (non-permitted colours used, the common being 'metanil-yellow'.
- (j) Testing of Vitamin A and B.

## MODERN NOMENCLATURE

### Inorganic

<i>Traditional</i>	<i>Modern</i>
Nitric oxide	Nitrogen oxide
Chlorate	Chlorate (V)
Hypochlorite	Chlorate (I)
Chromate	Chromate (VI)
Nitrous oxide	Dinitrogen oxide
Permanganate	Manganate (VII)
Orthophosphate	Phosphate (V)
Sulphuryl Chloride	Sulphur dichloride dioxide
Thiosulphate	Thiosulphate (VI)
Am. Silver Nitrate	Diamminesilver
Manganese dioxide	Manganese (IV) oxide

### Organic

Acetate	Ethanoate
Acetic acid	Ethanoic acid
Acetaldehyde	Ethanal
Acetamide	Ethanamide
Acetone	Propanone
Acetylene	Ethyne
Ethylene	Ethene
Aniline	Phenylamine
Methyl Alcohol	Methanol
Ethyl Alcohol	Ethanol
Benzyl Alcohol	Phenylmethanol
Carbon Tetrachloride	Tetrachloromethane
Diethyl Ether	Ethoxyethane
Oxalic Acid	Ethanedioic acid
Oxalate	Ethanedioate
Toluene	Methylbenzene
Olefine	Alkene
Ethyl bromide	Bromoethane
Formic acid	Methanoic acid
Glycine	Aminoethanoic acid
Phenol	Hydroxybenzene
Benzoic acid	Benzene carboxylic acid
Formaldehyde	Methanal

**BIOLOGY (863)**  
**Botany & Zoology**

**Aims :**

1. To view Biology as a process of inquiry into the living world.
2. To become familiar with the procedures and ways of thinking of the research scientist.
3. To have some understanding of the living world as so far revealed by scientific investigation.
4. To be able to interpret data, formulate hypotheses, test hypotheses, and develop broad generalizations.
5. To be able to use the concepts and methods developed in the course in new areas of study and everyday situations.
6. To be able to think critically : to require evidence, be able to weigh evidence, and assess the reliability of inferences drawn from it.
7. To realize that hypotheses can be held with varying degrees of confidence and that, because of the very nature of science, our understanding of the world is continually changing.
8. To make judgements which take into account the understandings and methods of science.
9. To be able to communicate ideas to others, both orally and in writing.
10. To develop practical skills in handling scientific apparatus and in making and recording observations.

In order to meet these aims, it is essential that a candidate's activities be organized so that ;

- (1) A major part of the work involves direct, personal observation and experimentation by the individual candidate.
- (2) He learns to find things out for himself, and to think critically.
- (3) Concepts arise from a candidate's own experience whenever possible. (Biological knowledge should not be presented as a rhetoric of conclusions).
- (4) Candidates gain practice in applying concepts developed in the course.

There will be two *theory* papers and a *practical examination* as follows

## Elective Subject

**Paper 1 (2 hours)** will consist of a number of structured short answer questions in Botany and Zoology.

**Paper 2 (3 hours)** will consist of traditional type questions. There will be two Sections as follows: Section A, 5 questions in Botany and Section B, 5 questions in Zoology. Candidates will be required to answer *three* questions from Section A (Botany) and *three* questions from Section B (Zoology).

**Paper 3 (3 hours)**, A Practical examination consisting of questions in Botany and Zoology in which there will be no choice.

The allocation of marks for the three papers will be as follows :

Paper 1 (Theory)	—70 marks
Paper 2 (Theory)	—90 marks
Paper 3 (Practical)	—40 marks

### BOTANY

#### Introductory Notes :

In addition to Field Work as outlined, candidates should be encouraged to study wild plants in their natural environment, and also to collect living material for laboratory investigation. The syllabus gives considerable latitude to the teachers in the choice of species for study. The study of types mentioned in the syllabus should not preclude reference to related organisms where these are well represented in the local flora or when they illustrate features of special interest.

It is recognized that in some schools not all parts of the syllabus can be studied with equal thoroughness. With these considerations in mind a choice of questions will be set, except in the Practical Examination. **The notes set in smaller type are intended to provide a guidance on the scope of the work.**

Practical and theoretical work should, wherever possible, be closely related. *The syllabus indicates examination requirements and it is not intended as a suggested order of teaching.*

#### I. Cytology and Histology

1. The Biophysical and Biochemical Basis of Plant Life.
  - 1.1 The physical properties of cytoplasm : colloidal properties ; diffusion; osmosis. The chemical nature of cytoplasm ; amino acids; peptide linkage ; proteins ; enzymes ; enzyme action and catalysis.

An understanding of the nature of the amino acids, without detailed structural formulae, and the manner in which they form protein chains and an outline of the structure and the role of the commoner monosaccharides is required. Candidates will be expected to have conducted qualitative and quantitative experiments on conditions affecting enzyme action.

## 2. The Structure, Differentiation and Organization of Plant Cells

- 2.1 Structure of a typical plant cell : cytoplasm and nucleus ; membranes ; vacuoles ; ribosomes ; mitochondria ; plastids ; chromosomes, nucleoli, cell walls ; cell division : meristems, primary and secondary meristems. Tissues : parenchyma ; collenchyma ; sclerenchyma ; mixed tissues (xylem, phloem) ; cambia.

The structure of the cell membrane, the cell wall in plants, the cytoplasm, plastids, mitochondria and chromosomes should be considered briefly so that their functions and interrelations may be appreciated.

Candidates will be expected to have handled and cared for the microscope and to have used it to examine simple preparations of plant cells such as : onion epidermis, potato pith, staminal hairs (e.g. *Tradescantia*), and chromosomes in onion root tip or anthers of onion, *lilium* or *aloe*.

## II. Morphology Anatomy and Classification

The divisions of the plant kingdom. The principles of classification should be clearly understood. The candidate should be able to assign a given plant to its correct Order and in some cases to its Family. For example, he should be able to recognize that *Hibiscus rosa-sinensis* falls under the order Malvales and Family Malvaceae. Reference may be made to the Bentham and Hooker's System of Classification.

Questions on the principles of classification will not be set in the theory papers, but an application of these principles may be required in the Practical Test.

### 3. Flowering Plants.

- 3.1 Morphology of flowering plants. External morphology of a typical dicotyledonous plant, e.g. *vicia* and a monocotyledonous plant, e.g. *maize*. Internal structure of dicotyledonous and monocotyledonous stems as seen with the aid of a microprojector or low-power microscope to show the distribution of vascular and mechanical tissues. Leaf structure : the internal structure of a typical leaf as seen under the high power of a microscope. The root and shoot systems should be treated as parts of a living organism showing how each is suited to its

## *Elective Subjects*

physiological functions. **Primary and secondary growth ; medullary rays ; heart wood and sapwood ; differences between herbs and trees.**

- 3.2 **Flowers and reproduction. Structure of flowers in relation to pollination ; pollination by agency of insects, wind and water. Cross-pollination and self-pollination in anemophilous and entomophilous flowers.**

Fertilization and the outlines of development of the seed and fruit from the ovule and ovary, without reference to microscopic details of ovule or pollen structure.

The morphology of fruits and seeds and the methods of dispersal.

- 3.3 **The morphology and natural history of the commoner species of the following families :**

**Dicotyledoneae ; Malvaceae, Papilionaceae, Cruciferae, Solanaceae, Compositae (*Helianthus*)**

**Monocotyledoneae ; Liliaceae, Graminae (zea and oats).**

In the work on flowers and reproduction the attention of the candidate should be drawn to the general uniformity of plan that prevails among flowers, and to the variations in the relations of parts characteristic of different families. Candidates should be taught to construct floral diagrams and to make drawings of transverse and longitudinal sections of flowers. They should be made familiar with the technique of cutting sections of stems and roots (dicot and monocot) by hand and the use of temporary stains.

**Gymnospermae ; Cycas or Pinus.**

- 3.4 **Seed germination : mobilization of food reserves ; dormancy ; viability; factors affecting germination.**

Reference should be made to hypogeal and epigeal germination, but the physiology of germination should be stressed rather than variation in morphological patterns.

- 3.5 **Food storage in seeds and vegetative organs. Vegetative propagation. Seasonal growth : Adaptations connected with persistence through unfavourable seasons. Structure and development of buds. Leaf-fall.**

One example of each of the following should be studied : bulbs, corms, rhizomes, stem tubers, root tubers and tap roots.

4. Flowerless Plants.

- (a) Viruses : their characteristics and the difficulty of their classification as living organisms.

Reference to one plant virus (e.g. Tobacco mosaic virus) and one animal virus (e.g. Flu virus) is required.

- (b) Bacteria : General elementary knowledge of their structure. Economic importance; harmful bacteria; resistance to disease; prevention of infection; bacteria culture.

- (c) A filamentous alga (e.g. *spirogyra*) : The green plant cell contrasted with the animal cell : reproduction including conjugation.

Microscopical examination.

- (d) A mould fungus : structure, nutrition, reproduction (asexual and sexual). Yeast : respiration (aerobic and anaerobic) ; fermentation of sugar : Bacterial fermentation contrasted with alcoholic fermentation ; economic importance. Concept of antibiotics (e.g. Penicillin).

Fungi. To include the culturing of yeast and a mould fungus such as *Rhizopus*.

- (e) Bryophyta : *Funaria* : morphology and life-history.

- (f) Pteridophyta ; *Selaginella*, *Nephrolepis* or any other fern, e.g. *Dryopteris*.

In the study of plant type omit : (i) Development of the gamelophytes, development of sexual and asexual reproductive organs and development of embryo, (ii) Anatomy of rhizome of *Nephrolepis*. (iii) Normal root of *Cycas* (iv) Comparison of the gametophytes of *Cycas* with those of *Helianthus* of *Zea*. (v) Anatomy of the petiole of *Helianthus*.

III. Physiology

5. Nutrition. (a) Elements necessary to plants; essential and trace elements ; mechanisms of passive and active absorption; intake of water and of salts and their movements through the plant; (b) Photosynthesis ; the effect of environmental factors on rates of photosynthesis and of transpiration; (c) the soil ; the carbon and nitrogen cycles.

The process of photosynthesis may be considered in two parts—the photochemical part and the part of carbon. It should be possible to give a reasonable explanation of the principles concerned : e.g. electron activation in chlorophyll, water as a source of hydrogen, presence of a hydrogen acceptor, formation of ATP and its role in energy-exchange,



the cyclic process involving different carbon compounds without going into bio-chemical details of the substance named. The importance of an energy supply and of the cell vacuole and its membrane in the absorption of mineral salts should be pointed out, but details of current theories on the subject are not expected. Quantitative experiments should be included in the study of photosynthesis and transpiration. For photosynthesis, the work should include experiments on the effect of varying (i) the intensity of light, (ii) the concentration of carbon dioxide, (iii) the temperature. For transpiration, experimental work should include a consideration of the physical principles involved in water loss from the plant and a study of the effects of such loss of varying the environmental factors. They are (i) osmosis; (ii) turgidity; (iii) root pressure; (iv) water-uptake by simple potometer and of waterloss by weighting a plant in a covered pot; (v) the effect of moving air. etc. on these rates; (vi) the use of cobalt chloride paper to determine surfaces of most rapid transpiration; (vii) uptake of dyes. Soils : simple estimation of the air, water and humus content of different soils; test for the presence of carbonate; comparison of important soils properties in different soils, water cultures, acidity and alkalinity; presence of soil organism; crop rotations.

6. Other modes of nutrition. Parasites and saprophytes. Insectivorous plants.

Translocation of metabolites : the part played by xylem and phloem; passive and active transport.

Demonstration of the accumulation of starch in leaves by day and diminution at night.

8. Respiration.

The sources of energy and the processes of energy exchange in plant metabolism ; aerobic and anaerobic respiration. Mitochondria as respiratory centres; respiratory enzymes, phosphorylation; high energy phosphate bonds and ATP. The rate of respiration; respiratory quotient.

It is more important to emphasize principles than biochemical formulae. The breakdown of glucose to pyruvic acid and the importance of phosphate supply should be made clear without attempting to name all the intermediate compounds. The fact that it is controlled, stepwise breakdown of glucose in which some energy is stored at ATP should be stressed. The different fates of pyruvic acid in aerobic and anaerobic respirations should be explained, including reference to the quantity of useful energy made available in each case. Details of the Krebs cycle are not required. Experiments involving measurements should be carried out on respiration. They should include those showing the influence

of the substrate on the amount of energy released and of environmental factors of the rate of the process.

**Growth.** Growth regarded as increase in size and complexity. Cell formation, growth and differentiation; condition necessary for growth; germination changes in seeds; part played by auxins in growth curvatures.

Observations should be made on growth on plants by weighing and by measurements of the length increases in stems and in roots.

Experiments in water uptake should be performed, and qualitative and quantitative observations made on the stages in germination of seeds.

**Response.**

(a) **Tropic and nastic responses in plants.**

Externally observable aspects of these phenomena should be studied experimentally as far as possible.

(b) **Photoperiodism.**

Elementary study with examples of short day plants and long day plants. Demonstration only of a few externally observable aspects of photoperiodism.

**Genetics and Evolution of plants.**

The concept of the gene and the chromosome theory of heredity. The structure and replication of chromosomes and the DNA and RNA molecules. Mitosis and meiosis; crossing over and linkage. Natural and artificial selection. Evidence for selection.

The nature of the evidence for evolution should be discussed. Some of the arguments are to be found in the earlier chapters of *Origin of Species*.

**Plants in Relation to their Environment.**

Nature, origin and development of soils, Soil texture, water content, aeration, nutrient level. Humus and its formation. Carbon, nitrogen and mineral cycles.

Plant distribution, the influence of topographic, edaphic, climatic and biotic factors; dispersal of seeds of fruits, influence of man on vegetation. Dynamic nature of communities. Seasonal changes.

Simple ecological methods for assessing the characteristics of environment and the inter-relationships of the plants within the community.

A study through the year of the vegetation of one of the follow-

## *Elective Subjects*

ing communities : seashore, lake, stream, mangrove swamp, cactus thorn scrub, savanna (parts of the Deccan Plateau) or montane rain forest.

It is envisaged that the candidate will collect and identify species of the chosen group from as wide a range of habitats as possible, and will observe their more obvious adaptation to those habitats.

## ZOOLOGY

### **Introductory Note**

This syllabus has been set out in detail to provide the fullest guidance on the scope of the work. The Notes set in smaller type are intended to help the teacher to estimate the depth of treatment that is expected. Notes relating to practical work in class are given in italics. They should be consulted in relation to the section on practical work.

It is not intended that the subject-matter shall be taught in any particular order. It is recognised that not all schools are able to study all parts of the syllabus with equal thoroughness. For this reason, choice of questions will be set in the theory paper. Since, however, the practical examination offers no choice of questions, it is important that the candidates should have experience to the practical work given in the Notes.

Practical work in class should form the basis, as much as possible, of the syllabus and, wherever possible, practical and theoretical work should be inter-related.

Throughout the syllabus importance is to be attached to observation of the living organisms and living tissues, where practicable, under natural conditions. Where topics such as behaviour are referred to, it is intended that the teaching should be based, as far as possible, upon observation of living animals. Questions on applied zoology may be set on topics not mentioned in the syllabus, the answers to which can be inferred from general principles.

It is assumed that candidates will have a sufficient knowledge of elementary chemistry to comprehend physiological processes.

### **I. The Cellular Organizations of Animals.**

1. (a) The physical and chemical nature of protoplasm, including
  - (i) an outline of the chemical nature of carbohydrates, fats,

a typical amino-acid and proteins, (ii) the colloidal state.

*Students should carry out at least one test for each of the following : reducing and non-reducing sugars, starch, fats and proteins.*

- (b) The animal cell and its components, with some reference to such cytoplasmic inclusions as mitochondria and the centrosome. The cell surface and its properties.

*Some simple staining techniques for the differentiation of the nucleus and cytoplasm (e.g. Leishman's stain for blood smears) should be carried out.*

The preparation of permanent mounts will not form a part of the examination.

- (c) Nucleic acid : an outline of the chemical nature of DNA and RNA, their distribution in the cell and their probable functions.

Chemical details of the individual nitrogenous bases of the nucleic acids will not be required.

- (d) Enzymes : their role in the cell.

Candidates should appreciate that cellular metabolism is controlled by a multiplicity of intra-cellular enzymes, including the respiratory oxidases and dehydrogenases.

*The action of some of the intra-cellular enzymes should be demonstrated experimentally: for example, the action of catalase may be shown by allowing a few drops of blood to fall into hydrogen peroxide solution.*

- (e) Cell division. Mitosis : its nature and significance.

*The stages of mitosis are probably more easily observed in prepared sections of plant tissues such as angiosperm roots tips.*

- (f) The differences between plant and animal cells, including the energy relationships.

Cellular organization of tissues. Simple tissues. Morphological differentiation.

The general principles might will be exemplified by reference to Hydra and the mammalian tissues and organs.

## I. The Mammal

2. The external features and the elements of the structure and physiology of a mammal exemplified by the study of the rat (or rabbit) and with special reference to Man.

Throughout the syllabus histological structure should always be related to the gross structure and functioning of the

## Elective Subjects

organ concerned. *All histological items mentioned should be studied in the practical work in sufficient detail to illuminate the relationship between structure and function.*

There is scope for experimental work in physiology, including some experiments which use the human subject.

*It is suggested that a general dissection of a mammal—rat or rabbit—could conveniently precede a more detailed examination of the various organ systems. Such a dissection would serve to show the overall arrangement and position of the main organs of the body.*

- 2.1 The main features of the digestive process in omnivores, carnivores and herbivores. The utilization of the products of digestion; the constituents of a balanced diet. Enzyme activity. Absorption. Need for a large absorbing area. Peristaltic action of gut walls. Importance of roughage. Simple outline of the part played by the liver in food storage.

Candidates should appreciate that omnivores, carnivores and herbivores differ not only with respect to dentition and jaw articulation but also in the form of the gut and its relation to the digestive process.

The utilization of the products of the digestion of carbohydrates, fats and proteins should be considered so as to appreciate their function, metabolism and the extent to which they are interchangeable.

*The alimentary tract should be dissected from lips to anus, together with the liver and pancreas and their ducts. A general idea of the mesenteric attachments of the organs should be appreciated and of the position of various organs in the abdomen.*

*Practical work on digestion can be useful to illustrate the ways in which environmental factors affect enzyme activity. The effects of temperature and pH on trypsin activity. Digestion of starch by salivary amylase. Diffusion illustrated by Visking tubing. Various slides to show villi and muscle layers in gut walls.*

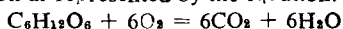
- 2.2 The respiratory organs and the mechanism of breathing, Gaseous interchange in the lungs and tissues. A general account of both the aerobic and anerobic aspects of tissue respiration including the role of ATP (adenosine triphosphate), in the process of energy transfer: illustrating its action in muscular contraction.

*In dissection, the position of the larynx, trachea, main bronchi, lungs, and diaphragm.*

*The action of ribs and diaphragm should be investigated by models. The natural elasticity of the lungs can be demonstrated by inflating a pair of sheep's lungs through a glass tube inserted into the trachea.*

The meaning of residual and tidal air.

Tissue respiration should be recognized as a more sophisticated process than combustion as represented by the equation.



Although complicated treatments such as would be involved in detailed accounts of the Krebs cycle are not required, tissue respiration should be considered as a process where fuel molecule is oxidized in stages, the total energy content of the molecule being released gradually and incorporated as high energy bonds with ATP molecules, this energy then being available for work within the cell.

- 2.3 The vascular system and the circulation. Functions and the uses of blood and lymph. The histology of blood and blood vessels. Circulatory and respiratory changes during muscular exercise.

Blood group O, A, B, AB. Universal donors and recipients RH factor (Rhesus factor)—reference to blood transfusions. (The mechanism of antibody/antigen reaction is not required).

*Dissection of a sheep's heart to include main vessels. Use of a dissected mammal to illustrate some of the other blood vessels.*

*Transverse section of artery and vein under microscope. Observation of capillaries in tail of tadpole, valves in aorta of sheep's heart and in veins of arms. The effects of exercise on heart rate and blood pressure can be readily demonstrated.*

- 2.4 The excretory system. A simple account of the action of the kidney tubules and the way in which they assist in the maintenance of the constancy of the body fluids. Outline of super-filtration and selective reabsorption. The histology of the kidney.

The account of the action of the kidney tubules should include pressure filtration in the capsules, and selective reabsorption in the tubules.

*In dissection, the kidneys, ureters and bladder and a general appreciation of the differences between male and female urethra.*

- 2.5 The skin : protective and sensory functions, temperature control. The histology of the skin including stratified epithelium, adipose tissue, hair, sweat and sebaceous glands.

Water conservation and temperature control are of prime importance and the skin is very much involved in both.

- 2.6 The defences of the body against injury and infection.

The work should include blood clotting, tissue repair and the ways in which invading organisms are eliminated. Immunity (prophylaxis against small-pox). Experiments can be done to show the factors influencing blood clotting, e.g. presence of calcium.

## *Elective Subjects*

### 2.7 Chemical Co-ordination.

The function of the endocrine system as exemplified by the thyroid, adrenals (cortex and medulla), pituitary, islets of Langerhans and gonads.

This section should be broadly treated, contrasting hormone control with nervous control. No detailed knowledge of the histology of the thyroid, adrenals and pituitary is required.

*This position of the main endocrine glands should be pointed out in dissection.*

### 2.8 Nervous Co-ordination. The nervous system, limited to the main regions of the brain, spinal cord and nerves (including an elementary knowledge of the autonomic nervous system). Reflex action; simple and conditioned reflex actions. The sense organs, especially the eye and ear.

Candidates should understand that a brain is an enlargement of the C.N.S. at the anterior end of the body in close proximity to the major sense organs. The main regions of the brain should be demonstrated in a dissected head. Study of eye of sheep.

Candidates will be expected to have seen transverse sections of spinal cord and nerve.

Examples to be recalled from daily life which demonstrate reflex action and conditioned reflexes.

### 2.9 The skeleton and the general relations of the muscles to the skeleton; three types of levers. The histology of bone; cartilage striated and cardiac muscles. Muscles of limb movement.

The general organization of an intact mammalian skeleton should be studied to show how it provides for support and movement. Such a study will introduce the main types of joints and the arrangement of muscles in antagonistic pairs of maintenance of posture and promotion of movements.

*Bones should be studied separately, as well as in relation to an intact skeleton, as follows : atlas; axis; a typical vertebra from each region of the vertebral column : a typical rib : the sternum.*

The local features apparent on the bones of the skeleton should be known for their functional significance rather than their complex nomenclature. No details of the bones of the skull are required.

The skull should be treated as a whole, showing how it provides protection for the brain and associated sense organs, and, at the same time allows for movements of the jaws and between itself and the vertebral column.

- 2.10 General organization of reproduction in the mammal, including an outline of the development and care of the young. The histology of testis and ovary. The reproductive hormones. Menstrual cycle.

An attempt should be made to integrate this section with the endocrine control of reproduction. In dissection, the general arrangement and position of the reproductive organs in both sexes.

The mammalian foetus. The placenta to be considered solely as an organ for the interchange of food and excretory products; an elementary knowledge of foetal membranes is required.

### III. The Variety of Animals

3. The classification of animal kingdom.

Living specimens should be examined whenever possible, and studied in aquaria and vivaria. *The external features of the animals should be studied*, especially those by which they can be assigned to their respective phyla, and those which show adaptation to habitat. In addition to looking at the animal as a whole and in relation to its environment, particular attention should be paid to the points of special morphological or physiological interest mentioned after each of the animals listed below.

The principles of animal classification should be clearly understood, but it is undesirable that the whole classification system should be studied *in detail*.

*The student should learn to place any common animal in its Phylum and in some cases in its Class.* For example he should recognise that a centipede and a spider are members of the Arthropoda.

#### (a) Protozoa.

Paramecium; protoplasm, locomotion, irritability excretion and osmo-regulation, life-history, Intracellular complexity contrasted with that of Metazoa.

*Observation of the avoiding reactions of paramecium. Effect on trichocysts of acetic acid.*

#### (b) Coelenterata.

Hydra : specialization of cells, behaviour, reproduction life-history.

#### (c) Platyhelminthes.

Tapeworm (human). Life-history and parasitic habit.

*Demonstration of tapeworm from the intestine of pigeon.*



## Elective Subjects

(d) Nematoda.

*Ascaris* or *Ankylostoma* : life-history and parasitic habit.

(e) Annelida.

Earthworm : Movement, nutrition, outline of the blood and reproductive systems, life-history, economic importance.

*The earthworm should be dissected to show the circulatory and alimentary systems. The student should also make temporary mounts of a cheta and a nephridium.*

(f) Arthropoda.

Insecta : The insect cuticle : structure water-proofing. Ecdysis, type of metamorphoses.

Cockroach (*e.g. Periplanata americana*) feeding, without details of individual mouth-parts : external features, gaseous exchange, life-history.

*The internal structure of a cockroach should be studied by dissection of the alimentary and nervous systems. The general features of the mouth parts should be considered in relation to food and feeding habits but the details of the individual appendages are not required.*

(g) Chordata.

(i) A fish : External features, respiration and locomotion.

*The vertebral column, fins and bronchial region should be studied in general terms only.* The object here should be to convey an understanding of how a fish moves and produces a respiratory current of water past the gill lamellae.

(ii) Frog or toad : External features, locomotion, gaseous exchange, transition from aquatic to terrestrial life, life history with a limited knowledge embryology and development.

The knowledge of embryology required is the minimum necessary to build up a general idea of the way in which reproductive cells of the organism are transformed into the new organism of the same pattern as the parents.

*The external features of tadpoles at various stages of development should be studied.*

*The frog should be dissected as follows : alimentary tract from buccal cavity to cloaca; the liver; the urogenital system; the blood vessels entering and leaving the heart, the main pattern only of the arterial supply and venous drainage of the trunk and limbs.*

Only the larger blood vessels need be studied but an idea should be conveyed of the main region each supplies.

- (iii) Bird : adaptation to flight and an elementary study of wing action. Structure of the egg. Nesting and care of the young in a named bird.

A comparison of the wing skeleton with the mammalian skeleton to point out adaptations to flight.

An outline of the first three days of development of a bird (e.g. chicken), as far as can be seen with a hand lens.

#### IV. The Interdependence of Living Organisms

##### 4. Principles of Ecology.

The main physical factors influencing living organisms.

Food chains, pyramid of numbers, biological equilibrium, fluctuations in population density.

To exemplify these topics the ecology of **either** a common group of animals **or** of the animals of some well-defined habitat should be studied. Such a study should therefore include some aspects of the following ; adaptations to the physical environment, adaptations to the biotic environment, food relationships, habits, and life histories. No restriction will be placed on the group of animal or the habitat chosen.

Suitable examples of habitats are : mangrove swamps, the sea shore, the soil, a mango tree, woodland, rubbish heads, dung etc.

The greatest importance is placed on practical field ecology, but it must be stressed that the most valuable aspect of this work is not just the collection and identification of representative animals from different environments but rather the development of an understanding from personal observation of the way such animals live in nature, are dependent upon each other, and upon the physical environment.

*Such an understanding will only come from practising field collecting and its associated identification together with accurate recording of environmental characteristics and an alert appreciation of what the animals are doing in that environment.*

#### V. The Continuity of Life

##### 5. Genetics

A simple outline of the behaviour of the nucleus in the maturation of germ cells and in fertilization.

Students should realize the importance of the pairing and subsequent separation of homologous chromosomes during meiosis and the significance of the haploid and diploid condition.

*The stages of meiosis should be studied by microscopic examination of stained sections of developing angiosperm pollen sacs, e.g. of *Lilium*.*

## *Elective Subjects*

Mendelism : monohybrid and dihybrid inheritance. Mendel's laws. An elementary study of linkage and crossing over, sex chromosomes and linkage.

The above section on Mendelism should be exemplified in part by reference to the mode of inheritance of such human characteristics as the ABO blood groups. RA factor, eye colour, red-green and colour blindness.

The evidence of the chromosome theory of heredity.

A simple introduction to modern ideas on the structure of chromosomes and on the genetic code.

This should include the structure of DNA (deoxyribonucleic acid) and an outline of the way in which genetic 'information' is thought to be encoded in the sequence of nitrogenous bases in the nucleic acid molecules.

### 6. Evolution.

An outline of the concept of evolution and the nature of the evidence for it, including the main features of the palaeontological succession.

Speculations concerning the origin of life could also be considered here.

Darwin's 'Origin of Species' and Natural Selection. Lamarckism.

An elementary account of the general features of human evolution.

## PRACTICAL EXAMINATION

### Paper 3 (Botany & Zoology)

#### **Botany :**

The main object of the practical examination will be to test the ability of candidates to make accurate observations on plant material with the naked eye and when using a hand-lens, or a microscope; in recording these observations clearly by means of drawings and diagrams or in writing; and in formulating reasoned conclusions from their observations. Questions may be set on any part of the syllabus. They may include :

- (a) Simple biochemical and physiological experiments, *e.g.* food tests, the effect of temperature on the activity of an enzyme. Full instructions will be given.

- (b) The preparation of stained and temporary mounted specimens for microscopic examination and the drawing and interpretation of these. The cutting of sections will not be required in the examination but candidates should be familiar with the technique of cutting sections by hand. Special attention should be paid to the preparation of diagrams illustrating the general distribution of tissues, and to drawings showing the exact form of constitution cell groups.
  - (c) The recognition of features of special botanical interest of the vegetative and reproductive parts of plants. An extensive knowledge of technical terms is not required.
  - (d) Construction of floral diagrams and the structure of flowers as seen in longitudinal sections and half-flowers. Construction of keys based on floral characters.
  - (e) The assignment of a given plant to its correct order and family.
  - (f) Plant collection and herbarium.
- Biological tours should be organized for candidates to enable them to collect plants of various types. Candidates should be taught to maintain herbarium.

## Zoology

### 1. Dissection :

*The Main purpose of any dissection* is not the naming and identification of an animal's parts but, as far as possible, for the candidate to see how these parts are arranged in terms of their interdependence and of the functions they have to carry out in life. For example, in the dissection of a mammal, the various regions of the alimentary canal should be considered in relation to the blood vessels and nerves that supply them.

### 2. Drawing :

A representation of a dissection or a specimen should show care over proportions, be neatly done with a **well sharpened pencil**, with or without the use of shading or colour, and should reveal accurate observation. It is important that candidates are taught to draw actual dissections **and not to reproduce memorized diagrams**. Such drawings should include an outline of the relevant region of the animal's body.

## *Elective Subjects*

In any drawing label lines should be neat and should not dominate.

Drawings made when using a microscope should in most cases include a low-power map and a high-power area representative of all the cells or tissues present. Again, students should be taught to make their own drawings from the actual specimen and not to reproduce diagrams memorized from text books.

### 3. *Examination :*

The purpose of the Practical Examination is to test the candidate's knowledge of Zoology and powers of observation when handling specimens. While a certain degree of manual dexterity is essential intelligent application of what has been learned from the entire course of teaching to the interpretation of practical material is more important. *It cannot be stressed too strongly that the purpose of this part of the examination is not primarily to test the candidate's memory for technical names, but to assess, his degree of understanding, particularly of the relationship between structure and function.*

**The Practical Examiners will assume that candidates will have carried out the Practical Work printed in italics.** Normally the Practical Examination will include dissection of one or more of the organ-systems from any of the five types of animals specified in the syllabus.

As far as possible candidates should be made to use fresh specimens. Teachers are advised to take steps to see that candidates are not faced with preserved material for the first time in the examination. Schools may be asked to provide some living or freshly killed material for the examination. In some instances although preserved material will be supplied some of the questions asked may only be answerable from what the candidate has learned in class when using living material.

The skills acquired in practical classes that it is possible to test under the conditions of the examination are those of dissection, drawing, use of microscope, certain staining techniques, certain simple biochemical tests, a few simple experiments and the candidate's power of observation.

Candidates may be asked to make mounts of such insect parts as legs tracheae and mouthparts or, by using smear techniques to make mounts

of other animal material. Appropriate instructions will always be given in the question paper.

It should be understood that a hurried drawing of a dissection will lose marks out of all proportion to the one or two gained by spending longer time in completing or tidying-up the dissection.

When a candidate is asked to draw, label and identify a specimen and cannot identify it, it is still possible for him to gain good marks by submitting a drawing showing accurate observation of the specimen with intelligent labels based on what he knows of similar structure in other animals or organs.

If candidates are asked to include notes on the functions of the parts they are labelling in a drawing it should be assumed that more credit will be given for showing knowledge of what a part does than what it is called. The note *and* the correct technical name should *both* be included.

## HOME ECONOMICS (864)

### Aims :

- (a) To develop an understanding in candidates of the principles of food planning and nutrition for the home.
- (b) To provide candidates with a basic knowledge of the different values of various foods.
- (c) To develop in candidates an interest in the knowledge of modern facilities in the home.
- (d) To develop in candidates an interest in the scientific basis of home appliances.

There will be *one* theory paper and *one* practical paper.

*Paper 1* : Section A Cookery and Nutrition.

Section B Science in the Home.

*Paper 2* : Practical Cookery (Three hours)

### Paper 1 : (3 hours)

*Candidates will be required to answer five questions, including two questions from Section A and two questions from Section B.*

*Candidates are expected to have some knowledge of elementary science in order that they may understand the scientific basis of the subject.*

### SECTION A : COOKERY AND NUTRITION

1. Elementary study of the chemical nature of proteins, fats and common carbohydrates (cellulose, starches, dextrans, singular sucrose, maltose, lactose, glucose, fructose). The physical and chemical changes brought about in food constituents by the action of enzymes and of such agencies as may play a part during cooking and storage, e.g. moist and dry heat, ultra violet light, acidity, alkalinity and atmospheric conditions. Calorific value of these food constituents.

2. Essential food constituents ; the more important mineral constituents, water and roughage ; the more important vitamins (fat soluble A, D, E and K, water soluble C and B complex). The effects, if any, of the agencies mentioned in paragraph 1 on these constituents, particularly the vitamins.

3. Functions of each of the essential food constituents in nutrition. The quantity of the various food constituents required by the individual in relation to his or her age, activity, climate, environment, etc. Relationship between nutritive value and cost. Food tables should be used in practical and theoretical work to determine the accurate composition and calorific value of meals, dishes and portions.

4. The digestive system including the liver and the pancreas. The absorption of food. The circulatory system and metabolism in so far as this affects food requirements.

5. The influence of available food and of environment and tradition on nutritional practices in different places. Current world food problems. Changing food habits in India. Dietary surveys of current interest.

6. Recent developments in food production and food processing. Sources of food supply. The care of food during transport, storage and distribution. The causes of decomposition and deterioration in food.

7. Food hygiene, home and public health. Food poisoning.

8. Principles of food storage and preservation in the home. Home freezing.

9. Selection of foods to satisfy the nutritional requirements of the family including convalescents and vegetarians. The planning of family meals and the influence of income, cooking facilities, personal preferences and time available, upon meal planning.

10. Organization in planning, preparation and serving of family meals for all occasions.

11. Kitchen planning. Choice, cost and care of kitchen equipment—current trends—new developments. Consumer advice and protection.

#### SECTION B : SCIENCE IN THE HOME

1. Carbohydrates, fats and proteins : the changes they undergo during cooking and digestion. Enzyme action.

2. Chemical and biological means of leavening mixtures based on wheat flour.



## *Elective Subjects*

3. Principles of food storage, food preservation and clean food handling.
4. Household pests and their control. Wood infestation.
5. Temporary and permanent hardness of water. Measures against hardness. Soaps and soapless detergents. Constituents of washing powders and washing-up liquids, etc. How detergents work.
6. Materials and finishes used for utensils and surfaces : care and cleaning thereof.
7. Effects of heat on solids, liquids and gases. Measurement of heat and of temperature. Thermometers (clinical maximum and minimum and others used in the home). Thermostatic control.
8. Changes of state. Boiling and freezing temperatures. Atmospheric humidity. Refrigerators. The effects of dissolved substances on the boiling temperature of water.
9. Ways in which heat is transferred. Domestic heating, hot water supply and heat conservation. Vacuum flask.
10. Fuels for domestic use : their relative merits, including cost. Kinds of gas available : sources of supply. Structure and working of domestic gas equipment, dangers associated therewith, and measures to take in case of accident.
11. Sources of energy for conversion into electricity. International co-operation and other means of reducing overall costs of electricity. Generation, transmission and distribution. Layout of domestic installation. Safe use of equipment and wiring. Structure and working of irons, heaters, cookers (including those with time switches), electric bells. Importance of earthing. Simple maintenance and repair jobs, e.g. inspection of flexes, replacing fuses, wiring of plugs. What to do in case of accident.
12. Forces, including centrifugal force. Levers and other simple machines.
13. Pressure : its role in gas and water supply. Atmospheric pressure, barometers. Syringe, syphon, lavatory flush. The effect of pressure on the boiling temperature of liquids. Pressure cookers. Aerosol containers.
14. Specific gravity. Hydrometers.
15. Lighting the home. Colour and the effects of light on colour-matching.

**Paper 2 : PRACTICAL COOKERY.**

The Practical Test will be conducted by a visiting examiner.

For the practical test there will be :

**1. Planning Session (Two and a half hours)**

Candidates may use food tables and recipe books in the planning session. They will be required to :

- (i) Choose one test from those set in the question paper.
- (ii) List the dishes chosen, giving source of recipes and stating the quantity of main basic ingredients.
- (iii) Prepare a list of ingredients to show the total quantities required.
- (iv) State *practical* and *nutritional* reasons for the choice and complete any written work and/or calculation required by the question.

**2. Examination Session (Three hours).**

Normally the paper will contain *three* or *four* tests, from which candidates will be required to choose *one*.

- (i) The practical tests will be closely linked with the nutritional aspect and the underlying scientific principles, relationship between the nutritive value and the cost will be required. Reference will have to be made to food tables to emphasise the composition of the staple foods and the calculation of the calorific value of simple foods of known recipes.
- (ii) The questions set may be based on the following :
  - (a) Simple tests for starch and sugars.
  - (b) Action of enzyme on foods, action of moisture and atmosphere.
  - (c) Cooking of meals. Balanced meals in relation to age, activity climate and environment.
  - (d) To find the cost of foods cooked in relation to daily food prices. Tests to determine accurate composition and calorie value of meals.
  - (e) Cooking of local foods.
  - (f) Processing of foods in pickles, chutneys and preserves. Home freezing. Use of a pressure cooker.
  - (g) Family meals based on income and cooking facilities.
  - (h) Meals for social occasions.

## NEEDLEWORK AND DRESSMAKING (865)

### **Aims :**

- (a) To provide candidates with the knowledge of various fashions and the fabrics that suit the fashion.
- (b) To develop in candidates an interest in the various processes to make the best use of materials.
- (c) To provide candidates with the basic scientific principles regarding the making and colouring of textiles.
- (d) To develop in candidates a sense of appreciation and creative expression in the making of clothes.

There will be *one* theory paper and *one* practical paper.

*Paper 1 : Section A : Fashion and Fabrics*

*Section B : Science and Textiles*

*Paper 2 : (Practical) Design and Pattern Cutting.*

### **Paper 1 : (3 hours)**

*Candidates will be required to answer five questions, including two questions from Section A and two questions from Section B*

#### **Section A : FASHION AND FABRICS**

1. Classification of fibres, natural and man-made : elementary study of the main properties of fibres with special reference to the effects of agents encountered today in wear, laundering and dry cleaning.

Relationship of the composition, construction and finish to the suitability of fabrics for various uses ; appearance, handle, practicability, durability and hygienic qualities.

2. Consumer protection. Trade description and advice.

3. Selection and estimation of fabrics and sewing notions for clothing and household items.

4. Fashion and current trends : wardrobe planning and wise buying of ready-mades. Suitability of fabrics, colours and accessories.

5. Creative use and appreciation of various types of decoration, including hand machine embroidery.

6. Use and adaptation of commercial patterns for style, size and fitting.

7. Equipment—choice, use, control and care.
8. Cutting out, fitting, making up and finishing of clothes and household items.
9. Knowledge of handling fabrics needing special care, for example, sheer, stretch, lace. Use of linings.
10. Care of clothes.

**Section B : SCIENCE AND TEXTILES**

1. Fibres—natural and man-made ; origin, chemical nature, structure, physical properties. Outline of production. Identification of fibres.
2. Yarns : blending, system of yarn manufacture, properties of yarn (twist, count, etc.), textured yarns.
3. Fabric structure, and properties such as felting. Weaving, knitting and other methods of fabric production including braiding.
4. Finishing processes as applied to yarns and fabrics.
5. Importance of colour in textiles : dyeing and printing.
6. Awareness of the limitations of fabrics and their special care.
7. Currently-developed fibres, fabrics and finishes. Fabrics of the moment such as simulated furs, non-woven fabrics and laminates; leather, fur, rubber and plastics.
8. A brief survey of the development of the textile industry ; social and economic effects.

**Paper 2 : (Practical test) DESIGN AND PATTERN CUTTING**

For the Practical Test there will be :

1. *Design and Drafting Session* (up to three hours to be allowed). During this session candidates will be required to design and sketch garments for herself, draft the patterns and write a shopping list of the required fabric(s) and notions.
2. *Preparation Session* (up to 1½ hours to be allowed). During this period candidates will be required to cut out, mark and prepare the garment for fitting.

**3. Examination Session : (3 hours).** The fit of the garment will be checked by the visiting examiner immediately before the beginning of the examination. During the examination session the candidate will be required to make any necessary corrections to the garment and pattern, and make up the garment according to the test requirements.

The visiting examiner will assess the course work.

Suitability of fabric and design as well as workmanship will be taken into consideration in the marking.

For each candidate the course work must include :

- (a) Block patterns cut to her own measurements (bodice, sleeve, skirt, trouser and kimono).
- (b) A toile for each block pattern.
- (c) Complete patterns and toiles for an outfit for formal or casual occasions, made to fit the candidate. All toiles must be fitted and corrected before using as patterns. Patterns must be complete with all pattern markings.

The outfit should then be made up in a suitable fabric. (The candidate will be asked to wear the outfit at the end of the practical examination).

- (d) A comprehensive file of  $\frac{1}{4}$  or  $\frac{1}{2}$  scale patterns with sketches, samples and suitable fabrics and suggested notions.

Credit will be given for originality, sound judgement, creative ability, skill, precision and a sense of proportion.

## ELECTRICITY AND ELECTRONICS (866)

The syllabus is not intended to be used as a teaching syllabus or to suggest a teaching order. It is expected that teachers will wish to develop the subject in their own way.

In the examination, questions will be aimed more at testing the candidates' understanding of fundamental principles, and the application of these principles to problem situations, than to their ability to remember a large number of facts. Some questions will include simple calculations.

An experimental approach to the subject is envisaged and it is assumed that candidates will spend adequate time on individual experimental work. Questions may be set requiring descriptions of experimental procedures. Candidates should also know how to exhibit the results of experiments graphically and how to make deductions from graphs. e.g. from intercepts and gradient in the case of straight line graphs ; deductions by interpolation.

Candidates will be expected to be conversant with SI units.

There will be *two* papers :

**Paper 1** will be a *two* hour written paper with Part I containing 18 short-answer questions set on any part of the syllabus and Part II containing one question designed to test practical applications.

*Candidates will be required to answer 15 questions in Part I and there will be a choice of parts within the question in Part II.*

**Part 2** will be a *three* hour written paper with Section A and Section B each containing 5 questions.

*Candidates will be required to answer five questions including at least two from each section.*

The sections are not related to specific parts of the syllabus.

### DETAILED SYLLABUS

1. *Introduction to electricity.* Structure of atoms ; the model atom, nucleus, electrons. Unit of charge ; coulomb. Potential difference and electromotive force. Production of electricity by friction, magnetism and chemical action.

## *Elective Subjects*

2. *Electric circuit.* Electric current,  $I = Qt$ . Ampere as rate of flow of charge. Ohm's law as applied to a single resistance ( $V/I = R$ ) and to a whole circuit ( $E/I = \text{total } R$ ).

3. *Equivalence.* Cell groupings. Resistances in series and parallel. Resistivity ;  $R = \rho l/A$ . Calculation of resistance of wire. Temperature coefficient of resistance. Ammeter shunts, voltmeter multipliers ; series ohmmeter.

4. *Work, power and energy.* Work and energy. The joule.  $E = VIt$  ( $QV$ ). Unit of power and energy ; the watt, the kilowatt the watt-hour and kilowatt-hour. Use of watt-meter. Calculation of electrical energy and power. Local tariff system.

5. *Heating effect of an electric current.* Application of heating effect e.g. heating appliances, filament lamps, electric welding, electric carbon arc, and use of fuses.

6. *Chemical effect of an electric current.* Electrolytes and non-electrolytes. Elementary phenomena of electrolysis, including the electrolysis of acidified water, and of copper (II) sulphate solution using copper or platinum electrodes. The factors affecting the mass of substance liberated in electrolysis and the measurement of current by voltameter (coulometer). Primary cells ; Leclanche cell ; polarization ; local action. Accumulators ; construction and characteristics of lead-acid cell ; techniques of testing and charging batteries ; care and maintenance.

7. *Electromagnetism.* Simple phenomenon of magnetism. Ferromagnetic properties of iron and steel. Magnetic effect of an electric current. The magnetic field associated with a current flowing in a straight wire, a circular coil, and a solenoid. Force on a current-carrying conductor in a magnetic field ; the right-hand and corkscrew rules. Magnetic flux density. Permeability.

8. *Electromagnetic induction.* Phenomenon of electromagnetic induction. Faraday' law : Lenz's law. Induced e.m.f. ; a straight conductor cutting flux ;  $E = -d\phi/dt = BLv$ . Self-inductance ;  $E = -Ldi/dr$ . Mutual inductance ; the induction coil.

9. *Elementary electrostatics.* Electric field ;  $E = V/d$ . Capacitance and the factors affecting capacitance. Electric flux density ;  $D = Q/A$ . Permittivity ;  $\mu = D/E$ . Energy of charged capacitors in series and in parallel.

10. *Alternating current.* Generation of an a.c. with a single loop coil. Sinusoidal wave form. Peak values ; r.m.s. values (Only ratios will be expected.) Simple a.c. circuits.

11. *Transformer.* Principle of the single-phase transformer, Turns ratio or voltage ratio. Rating of a transformer. Copper loss and iron loss (hysteresis and eddy current).

12. *Distribution of electric power.* Idea of a simple distribution system. Mention of the local power system should be made.

13. *The d.c. generator and motor.* Use of split-ring commutators ; constructional features. Shunt series and compound field connections and their characteristics. Starting of d.c. motors. Ideas on back e.m.f.

14. *The a.c. motor.* Ideas on a.c. motors (single phase only). The rotating field. Methods of shunting : capacitance start, split phase start. Single-phase induction motor types.

15. *Lighting.* Common types of lamps ; candela, lumen, lux, lux meter (light-meter). Illumination and photometry. Gas-filled lamps and fluorescent lamp circuits ; preheat, instant and rapid starts.

16. *Wires, cables and electrical wiring.* Construction of various types in domestic and industrial use. (Solid and stranded cables—how insulated and protected. Flexes). Selection of cable sizes, voltage drop and simple calculation on current-carrying capacity. (Linking of size of cables and flexes with maximum current flow particularly in relation to the circuits below. Regulation B 23 (voltage drop). Brief description of the wiring systems. Simple circuitry. (Separation of lighting and power circuits. Layout of lighting circuits. Switch in phase line. Dual switching of lamps. Layout of power circuits—ring and spur types—limitations.) Introduction to rules and Regulations, both local and that of I.E.E. (Sequence of equipment. Effects of over-loading. Protection of circuits and individuals by (a) fuses and trips, (b) earthing of metal, (c) mechanical protection of cables. Regulations for bathrooms. Commonsense appreciation of dangerous practices. Simple testing).

17. *Electrical accessories.* Structure and uses of various types of switches, power outlets, lamp holders, ceiling roses and junction



## *Elective Subjects*

boxes. [Familiarity with these is expected (but no questions will be set needing detailed knowledge of structure). Where and how they are used].

18. *Introduction to electronics.* Concept of electron flow. Common components employed in electronic circuits ; resistors capacitors and inductors ; their structure, types and uses.

19. *Diodes.* Thermionic diode ; semiconductor diode. Structure of vacuum diode and semiconductor diode.

20. *Power supply for electronic apparatus.* Mains transformer. The diode; half wave, full wave and bridge rectifiers, voltage doubler. Filters ; *RC* filters, chokes, bleeder resistance and its functions.

21. *Vacuum triode.* Structure of the vacuum triode valve. The control grid. Triode valve characteristics. Triode parameters ; anode resistance, mutual conductance and amplification factors ; relationship between the above parameters. Triode as a voltage amplifier. Bias voltage, cathode resistor and cathode bypass capacitor.

22. *Transistor.* The junction transistor : P—N—P and N—P—N types. Introduction to various methods of construction ; their characteristics including handling procedures and precautions.

23. *Transistor amplifier.* Introduction to the common-base, common-emitter and common collector amplifiers. Comparison of the voltage, current and power gains and input and output resistances (elementary approach only). Phase relationship. Bias stabilization.

24. *The amplifier.* A typical amplifier voltage and power amplification. Matching of the power output stage to a speaker.

25. *Apparatus for reproducing and recording sounds.* Range of hearing, recording and reproducing. Characteristics of micro phones ; carbon, crystal, moving-coil and ribbon types. The common types of gramophone pick-ups. The earphone, crystal and magnetic types. The moving-coil loudspeakers ; permanent magnet. Electrostatic speaker.

26. *Common types of electronic measuring instruments.* Valve voltmeters, transistorised voltmeter, signal generator, oscilloscope, use and care of the above instruments.

## ENGINEERING SCIENCE (867)

This subject may not be taken with Physics

The syllabus is designed for candidates who have followed a course with a bias toward engineering.

The examiners will attach importance to an understanding of scientific principles and will look for evidence that these have been studied practically. The examiners may ask to see the practical notebooks.

There will be *two* papers of *three* hours each.

**Paper 1** : will consist of two sections, A and B. Section A will contain short-answer questions, *all* of which are to be answered and Section B will contain *five* questions of which candidates must answer *three*.

**Paper 2** : will contain *eight* questions, of which candidates must answer *five*.

*Note* : All questions will be set in the S. I. system. The unit abbreviations to be used in all question papers in this subject will be those contained in the Guide to the use of International System (SI) units SP ; 5-1969 (Published by the Indian Standards Institution). A list of common abbreviations is printed at the end of the syllabus.

1. *Velocity and acceleration* Laws of motion. Force, mass and acceleration. Acceleration due to gravity. Measurement of *g*.

Including examples of bodies moving with variable acceleration, treated graphically.

2. *Angular velocity and angular acceleration*. Simple problems

3. *Composition and resolution of velocity*.

on projectiles.

Involving combined horizontal and vertical motion.

4. *Measurement and effects of force*. Equilibrium of concurrent forces in plane. Parallelogram, triangle and polygon of forces.

## *Elective Subjects*

Reaction, resultant and equilibrant. Bow's notation. **Equilibrium** of body on inclined plane.

Treatment by graphical and mathematical methods.

5. *Moments*. Application to parallel forces, levers, vertically loaded rigid beams. Centre of gravity : experimental determination and calculation in simple cases. Its relation to stability.

6. *Strength of materials*. Simple problems. Hooke's law, Stress and strain. Young's modulus. Tension and compression. Elastic limit. Ultimate strength. Factors of safety.

7. *Friction*. Conditions affecting friction. Lubrication.

Conditions should include types of materials, their surface finish, and wetness or dryness.

8. *Limiting friction*. Coefficients of friction.

9. *Work*. Work done by constant and by varying force ; graphical representation of, and calculations thereon. Energy, potential and kinetic. Conservation of energy and conversion into work, work done in rotation. Torque.

10. *Machines*. Simple single-string pulley systems. Simple and differential wheel and axle, Weston pulley block. Screw jack. Worm (single start thread and wheel). Gear and belt drives. Velocity ratio, mechanical advantage and efficiency.

11. *Power*. Simple treatment of steam and internal combustion engines. Indicators diagrams. Indicated mean effective pressure. Indicated and brake horsepower. Methods of measurement of power. Rope brake and Prony brake. Hydraulic power (as given by the product of constant pressure and rate of volume change). Mechanical efficiency.

Relationship between rev/min and working strokes per minute in double-acting steam engines and in two and four-stroke internal combustion engines. The oscillating cylinder steam engine is not required.

12. *Momentum*. Conservation of momentum.

Including rate of change of momentum and relationship with mass and acceleration. Knowledge of coefficient of restitution is not required.

13. *Pressure in liquids and its transmission.* Principle of **Archimedes** ; floatation. Density and specific gravity of solids and liquids. Simple hydraulic pumps and jacks. Lift and force pumps ; the siphon.

14. *Air Pressure.* Boyle's law. Barometers. Manometers and the Bourdon gauge. The bicycle pump.

Details of the Fortin barometer are not required.

15. *Temperature and temperature scales.*

16. *Thermal expansion of solids, liquids and gases.* Coefficient of linear expansion of solids and coefficient of cubical expansion of liquids and gases. Charles' law. Absolute temperature.

Questions will not be set on apparent coefficients of expansion.

17. *Quantity of heat.* Joule, Centigrade heat unit. Specific heat capacity of solids and liquids ; their determination. Change of state, Latent heats ; their determination. Melting and boiling points ; the effect of pressure. Heat as a form of energy. Calorific value of fuels (excluding experimental determination).

18. *Conduction, convection and radiation.*

19. *Conversion of heat to mechanical energy and vice versa.* Mechanical equivalent of heat.

Including any one method of determination.

20. *Magnetism.* Magnetic properties of iron and steel. The magnetic circuit ; qualitative treatment only, with examples from transformers and machines. The compass needle. Magnetic effect of current in straight wire, single turn coil and solenoid, treated qualitatively. Electromagnets and their simple applications. Relation of direction of current in conductor and lines of magnetic force applied.

Examples of the application of electromagnets to include electric trembler bell and relay.

21. *The simple circuit.* Conductors and insulators, Electromotive force, potential difference, current, quantity and resistance ; the volt, ampere, coulomb ampere-hour and ohm. Ohm's Law. Measurement of resistance, including Wheatstone bridge, Resistivity. Resistors in series and in parallel.

## Elective Subjects

22. *Heating effect of current.* Energy and power. Conversion of electrical to mechanical energy and vice versa. The joule, watt, and kilowatt-hour. Simple applications of heating effect. Effect of temperature on resistance. Temperature coefficient.

Examples to include various domestic heating appliances and filament lamps.

23. *Chemical effect of current field.* Electrolytes. Electrolysis. Electrochemical equivalent. Production of current by chemical action. Simple voltaic cell. Primary and secondary cells. Polarisation : prevention and removal. Cells in series and in parallel.

Chemical equations are not required.

24. *Current-carrying conductor in magnetic field.* The d.c. motor including series and shunt windings. Galvanometers, voltmeters and ammeters. Shunts and multipliers.

A qualitative treatment of multiple d.c. motors is included.

25. *Electromagnetic induction : the laws of induction.* Back e. m. f. of motor. Starting resistance for d.c. motor, Simple a.c. and d.c. generators. Relation of direction of lines of force, motion of conductor and current in coil. Eddy currents. Transformers. The induction coil ; the coil ignition system.

A qualitative treatment of multipole d.c. generators is included.

### List of abbreviations for the names of units.

metre	m	Kilogram-force	kgf
square, cubic metre	$m^2$ $m^3$	newton	N
cubic centimetre	$cm^3$	atmosphere (pressure)	atm
litre	l	conventional millimetre of mercury	mmHg
millilitre	ml		
second (time)	s	joule	J
minute (time)	min	watt	W
hour	h	watt hour	Wh
day	d	degrees (temperature)	$^{\circ}C$ , $^{\circ}K$
cycle per second	c/s	degrees (interval)	degC, degK degF

revolution per minute rev/min

gram	g	ampere		A,amp
gram-force	gf	volt		V
kilogram	kg	ohm		$\Omega$

**Prefixes**

×	$10^{-6}$	mega	M	×	$10^{-2}$	centi	c
×	$10^{-3}$	kilo	k	×	$10^{-2}$	milli	m
×	$10^{-1}$	deci	d	×	$10^{-6}$	micro	$\mu$

## COMPUTER SCIENCE (868)

### Aims

On successful completion of the course, a student should :

- (a) comprehend the concepts and practices of computer science,
- (b) know how computers store and process data,
- (c) be able to describe the major components of computer hardware and their functions and interaction,
- (d) be able to develop models of events or systems,
- (e) be able to solve problems using algorithmic techniques,
- (f) comprehend and be able to apply the fundamental concepts of programming,
- (g) be able to devise, test, code, document and validate programs to implement various algorithms,
- (h) have an insight into the range of applications of computers,
- (i) appreciate some implications of computer use in contemporary society.

There will be *two* papers as follows :

Paper 1 : Theory (*Three hours*). This paper will be divided into two Sections. **A and B.**

Section A will consist of a number of compulsory short answer questions.

Section B will consist of long answer type questions.

*Candidates will be required to answer four questions out of seven.*

Paper 2 : Practical (*Three hours*)

The allocation of marks for the two papers will be as follows :

Paper 1 (Theory)	—100 marks
Paper 2 (Practical)	—100 marks
	(80 marks for Practical 20 marks for Project)

### Paper 1 : Theory

#### Item

#### Notes

### 1. Computer Structure and Peripherals.

- (i) Computers, historical development of data processing : generations of computers. Review of class X work ; reference to new developments.

- (ii) The Central Processing Unit (CPU) and Arithmetic and logic Unit (ALU)      Review of the CPU and ALU ; main memory unit (Primary storage)—magnetic core, bubble, semi-conductor memory (flip-flops or storage cell) ;
- (iv) Input/Output devices or units      RAM or R/W memory, ROM ; special purpose semi-conductor memories—PROM and EPROM;
- (v) Auxiliary storage      difference between SAM (Sequential Access Memory) and RAM.
- (vi) Capacity
- (vii) Computer classification

Information is stored in bits, nibble, byte, character, word, Kbytes; binary arithmetic and how the computer uses it ; boolean algebra ; truth or decision tables ; logic gates and their symbols, using switching circuits to understand logic gates ; use of diodes.

Hollerth Cards, paper tape, disks, winchester drives, magnetic drums, card reader, VDU, printers.

Computer capacity, digital, analog, hybrid computers ; micro-mini-mainframes, super ; A.I.

## **2. Introduction to Software**

- (i) Meaning of software
- (ii) Operating Systems (O.P.)      OP—supplied by manufacturer, assemblers, compilers, interpreters ;
- (iii) Batch Processing
- (iv) Multiprogramming
- (v) Time sharing
- (vi) Programming Language      Refer to machine and assembly language (see section 3) ; high-level languages — BASIC, FORTRAN, COBOL, PASCAL, ALGOL—meaning of these terms, purpose/



area of use of these languages ;  
Statements in any programming  
language may be classified as :

- (1) specification statements,
  - (2) assignment statements,
  - (3) I/O statements,
  - (4) transfer statements,
  - (5) Control statements.
- (vii) Steps in program pre- (1) Problem formulation,  
paration (2) setting up the algorithm,  
(3) flowcharting,  
(4) developing, running and, if  
necessary, debugging the  
program.

### 3. Number systems and coding Schemes

- (i) Binary number system How the computer uses binary arithmetic (see section 1—notes)
- (ii) Octal Number system
- (iii) Decimal-to-Octal conversion
- (iv) Binary-to-Octal conversion
- (v) Hexadecimal Number system
- (vi) Decimal-to-Hexadecimal conversion
- (vii) Binary-to-hexadecimal conversion
- (viii) Binary Coded Number systems BCD systems
- (ix) American Standard Code for Information Interchange (A S C I I).

**4. Flowcharts**

- (i) Algorithms
- (ii) Flowchart symbols
- (iii) Developing a flowchart.

**5. Programming in Basic**

(i) *Constants and Variables*

- (a) The Character Set
- (b) Constants
- (c) Variables
- (d) Naming the variable
- (e) Getting Data into the Memory.

(ii) *Expressions in Basic*

- (a) Arithmetic Expressions
- (b) Hierarchy of Operations
- (c) Rules of Arithmetic

Fixed point, floating point representation of non-integers ; mantisae, exponent, fraction, base ; round off error.

- (d) Evaluation of Expressions

The LET Statement

- (e) Refinements in Programming

Use of REM, DIM, slash (/) colon, counters, STEP, RESTORE

- (f) Logical Expressions

- (g) Library Functions

(iii) *Printer Controls*

- (a) The Comma Control
- (b) The Semicolon Control

## *Elective Subjects*

- (c) The TAB function
- (d) The Print Using Control
- (iv) *Jumping, Branching and Looping.*
  - (a) Jumping—The GOTO Statement
  - (b) Branching—The IF...THEN STATEMENT ;  
IF...THEN...ELSE
  - (c) Multiple Branching—The ON...GOTO Statement
  - (d) Looping—The FOR...NEXT Statement.
- (v) *Subscripted Variables*
  - (a) Single—Subscripted variables
  - (b) Double—Subscripted variables
  - (c) Searching and sorting.
- (vi) *Functions and Subroutines.*
  - (a) User—Defined Functions
  - (b) Subroutines
  - (c) Multiple—Parameter Functions
  - (d) Multiple—Line Functions
  - (e) Named Subroutines with Arguments.
- (vii) *Histograms and Graph Plotting.*
- (viii) *Matrix Algebra.*
  - (a) Reading and Printing of Matrices
  - (b) Matrix Additions and Subtractions
  - (c) Matrix Multiplications
  - (d) Special Matrix Operations
  - (e) Solution of Simultaneous Linear Equations
  - (f) Initializing Matrices.
- (ix) *Character String Manipulations.*
  - (a) Subscripted String Variables
  - (b) The IF.....THEN Statement
  - (c) ASCII Code and the ASC Function
  - (d) Alphabetical Sorting.

- (x) *Comparative Study of Computer Languages* Machine Language—a sequence of Is and Os ; difficult to learn and difficult to correct mistakes; assembly language—number codes replaced by mnemonic name codes; comparison of BASIC, FORTRAN and COBOL in the following respects (i) alphabetic (ii) numeric, (iii) special ; given a programme of a few lines in simple, single loop instructions of BASIC to rewrite it in FORTRAN and/or COBOL and reversely.

#### 6. Case Studies

Each candidate is to choose one project. The completed project is to be submitted for assessment at the beginning of the planning Session of the Practical examination.

Some suggested topics :

- (a) Electricity Bill Problem
- (b) Town Developments Flat Allocation Problem
- (c) Class Results Tabulation Problem
- (d) Payroll

#### Paper 2 : PRACTICAL

The Practical Test and assessment of Project Work (Syllabus item 6) will be conducted by a visiting examiner.

The practical test will consist of two parts as follows :

##### 1. Planning Session (*Three hours*)

**General.** Candidates will be required to do the following :

- (i) Submit the completed project (Syllabus item 6) at the beginning of the Planning Session ;
- (ii) Choose one question from those set in the question paper;
- (iii) Prepare a flow-chart and a Computer program in BASIC.

##### 2. Examination Session (*Two hours*)

The Computer program handed in at the Planning Session will be returned to the candidates.

Candidates will be divided into two groups.

### *Elective Subjects*

The candidates of one group will be required to run their programs individually on the Computers or terminals and submit the print out result to the visiting examiner.

The candidates of the other group will be tested orally on their project work submitted at the Planning Session.

At the end of the first half of the session the groups will be interchanged.

Wide differences between the planned program and the print out are liable to heavy penalty.

## GEOMETRICAL AND MECHANICAL DRAWING (869)

This subject may not be taken with Geometrical and Building Drawing.

There will be *two* papers as follows :

**Paper 1 :** (2½ hours) Plane and Solid Geometry.

**Paper 2 :** (3 hours) Drawing (Engineering).

Candidates will be required to reach a minimum standard in the subject as a whole. The use of drawing board, tee-square and set-squares will be required. (Candidates may, if they wish, use a drawing board fitted with a parallel motion straight edge. The use of drafting machines will be permitted). A2 size paper will be used. The recommendation of IS : 696-1972 *Indian Standard, Code of Practice for General Engineering Drawings should be followed.*

*Paper 1 :* Section A Plane Geometry.

Section B Solid Geometry.

*Paper 2 :* Drawings (Engineering)

**Paper 1 :** (2½ hours)

*Candidates will be required to answer six questions : three from each section.*

### SECTION A : SOLID GEOMETRY

Construction and use of scales including diagonal scales. Enlargement and reduction of irregular plane figures. Construction of triangles, quadrilaterals and polygons. Similar plane figures. Problems on circles, tangents and normals. Loci such as the paths of points in simple link mechanisms. Methods of construction of ellipse, including its elementary properties, parabola and rectangular hyperbola : cycloidal and involute curves.

### SECTION B : PLANE GEOMETRY

Orthographic projection. (Diagrams printed in the question papers may be in either First or Third Angle projections ; the projection used will be stated. Solutions in either First or Third Angle projection will be accepted). Projection involving use of auxiliary planes : simple problems on auxiliary projection. Simple problems on the intersection of prisms, pyramids cylinders, right circular cones, and spheres. Determination of true length of a line in space :

## *Elective Subjects*

sections, and surface development of prisms, pyramids, cylinders and right circular cones. Helix treated as a locus with applications on the projection of helices. Isometric and oblique projection without the use of Isometric scale.

### **Paper 2 : (3 hours) DRAWING (ENGINEERING)**

*Candidates will be required to answer all questions.*

The preparation of working drawings and assemblies from dimensioned sketches based on the following :

- (a) fastenings (nuts, bolts, studs, keys, cotters, pins, locking devices) ;
- (b) rigid and flexible joints ;
- (c) screw threads ; their projection and the proportions of standard types ; profiles and proportions of spur gear teeth ; conventional methods of drawing gear wheels ;
- (d) transmission of motion and power, bearings, supports shafts, coupling and clutches ;
- (e) pressure transmission in pipes using water, oil, steam, and gas, joints, unions, tees and bends, expansion joints, pressure packing ;
- (f) constructional details of prime moves and simple machine tools ;
- (g) the use of reference points and planes in dimensioning, machining and surface texture symbols ;
- (h) toleranced dimensions involving the use of IS : 919 or B.S. 4500 *Limits and Fits for Engineering*.

Candidates will be expected to follow the recommendations given in IS : 696-1972 *Indian Standard, Code of Practice for General Engineering Drawings*. They should be familiar with both First and Third Angle projections.

## GEOMETRICAL AND BUILDING DRAWING (870)

This subjects may not be taken with Geometrical and Mechanical Drawing.

There will be *two* papers as follow :

**Paper 1** : (2½ hours). Plane and Solid Geometry.

**Paper 2** : (3 hours). Building Drawing.

Candidates will be required to reach a minimum standard in the subject as a whole. The use of drawing board, tee-square and set-square will be required. (Candidates may, if they wish, use a drawing board fitted with a parallel motion straight edge. The use of drafting machines will be permitted). A2 size paper will be used. The recommendations of IS : 962 : 1967 *Indian Standard, Code of Practice for Architectural and Building Drawings* should be followed.

The use of models is to be encouraged in studying this syllabus.

*Paper 1* : Section A Plane Geometry.

Section B Solid Geometry.

*Paper 2* : Building Drawing

**Paper 1** : (2½ hours)

*Candidates will be required to answer six questions ; Three from each section.*

### SECTION A : PLANE GEOMETRY

Construction and use of scales including diagonal scales. Enlargement and reduction of irregular plane figures. Construction of triangles, quadrilaterals and polygons. Similar plane figures. Problems on circles, tangents and normals. Loci such as the paths of points in simple link mechanism. Methods of construction of ellipse, including its elementary properties, parabola and rectangular hyperbola : cycloidal and involute curves.

### SECTION B : SOLID GEOMETRY

Orthographic projection. (Diagrams printed in the question papers may be in either First or Third Angle projection ; the projection used will be stated. Solutions in either First or Third Angle projection will be accepted). Projection involving use of auxiliary planes ; simple problems on auxiliary projection. Simple problems on the intersection of prisms, pyramids, cylinders, right circular



## *Elective Subjects*

cones, and spheres. Determination of true length of a line in space : sections, and surface developments of prisms, pyramids, cylinders and right circular cones. Helix treated as a locus with applications on the projection of helices. Isometric and oblique projection without the use of isometric scale.

### **Paper 2 : (3 hours) BUILDING DRAWING**

*Candidates will be required to answer all questions.*

The course on building drawing should be based on the form and construction of simple buildings and parts of buildings ; small dwelling houses (single and two storey), garages, sheds and green-houses.

Orthographic projection in either First or Third Angle projection, including sectional views of buildings and parts of buildings and building details, e.g. foundations, walls (including openings), jambs, sills, lintels and arches, floors and roofs, doors and windows, simple stairs.

Preparation of simple working drawings and details from free-hand sketches.

Freehand sketching on both orthographic and pictorial form of simple building details and tools used in the various building crafts and school workshops such as hammer, mallet, tri-square, plane chisel, trowel, screwdriver and the like.

Drawing paper (folded) will be provided but candidates may use any type of drawing paper for answering the question provided it is of suitable quality and of the correct size.

## ART (871)

### Aims :

- (a) To encourage creative expression in Art.
- (b) To develop the powers of aesthetic appreciation.

### GENERAL

(a) Any medium may be used provided that it is suitable for the subject. Painted work must be carried out in a quick-drying medium and must be completely dry before it is despatched. When acrylic paint is used for examination work, it must be mixed with water. All paints used must be of adequate quality : if coloured crayons or chalk are used, they must have a range and quality comparable with that of paints and must be carefully fixed at the examination centre before the work is sent to the Council. Monochrome may be used where permitted by the regulations for each Paper but will not be accepted as satisfying the requirement in respect of colour for Paper 4.

(b) Candidates must use their judgement with regard to (i) the size of a drawing or painting, (ii) the proportion of height to width within the space available. In all cases credit will be given for good composition.

(c) In each of Papers 1 to 4 the test is one of free drawing or painting, therefore and mechanical means of execution of the drawing or painting, (such as measuring or ruling) are not allowed. Instruments and tracing paper are allowed for Paper 5, but candidates are advised to restrict their use as far as possible.

(d) Where question papers or printed instructions provide for alternative groups, etc., the Supervisor in consultation with an Art Teacher will decide which of these alternatives is to form the subject of the examination, after taking account of local convenience, etc. At centres for candidates from more than one school, both of the alternative subjects in Paper 2 (Plant Drawing) must be provided if they are required by schools or candidates.

## *Elective Subjects*

(e) Suitable alternative subjects will be provided for the different areas, so far as this may appear desirable ; account will be taken of different climatic conditions in the section of flower specimens, etc.

(f) The paper supplied for use in the examination room will be about 35cm×25cm. Schools or candidates wishing to work on a larger scale, *not* larger than Half Imperial or Royal (64 cm×51 cm), or on a different type or tone of paper, will be at liberty to provide their own. Work which is carried out on stiff boards, or which is mounted, cannot be accepted. The paper used by candidates must not be less than 35 cm×25 cm and the work submitted must fill or approximately fill the page.

(g) **All drawings must be packed flat and not rolled** : Half Imperial and Royal sheets should be folded across the middle. When drawings are too large to enclose in the envelopes provided it is essential that the information required on the front of the envelope be given and that the envelope itself be packed in the same parcel with the drawings.

(h) Examiners are caused great inconvenience by candidates failing to write their examination numbers either clearly or correctly, thus making identification difficult. Schools are asked to co-operate by impressing upon candidates that they must write their names and full examination numbers (e.g. John Smith B802/021) both clearly and correctly on their examination work, and that on drawings and paintings this must be written on the front (top right hand corner) and also on the back. They must not write anything else on the front of the picture. Failure to observe this instruction may result in loss of marks.

### *STANDING INSTRUCTIONS FOR SUPERVISORS*

#### **Paper 1-3**

The printed 'Instructions, for these papers which are sent to schools will in advance of the examination will be limited as far as possible to the subjects of the tests. They are for the use of the Supervisor only, in consultation with the Art Teacher.

It is important that early attention should be given to the provision of the objects and/or models required. In papers 1 to 3, both alternatives must be set if required by candidates.

The group or subject should be arranged so that each candidate obtains an uninterrupted view : for Paper 1 candidates should not be more than 3·60 metres from the group. Candidates may form a semi-circle but not a complete circle round the group ; more than one session may be arranged if there is a large number of candidates. The examination must be held in good light but care must be taken that sunlight does not fall upon the group or subject while work is in progress. If the group or subject is painted, the back-ground must be included.

The surface on which is arranged the group of objects for Paper 1 and the group for painting only in Paper 2 must be below the eye level of the candidates.

### **Drawing or Painting from Nature**

#### *Alternative A. Study of the structure of natural forms.*

It is desirable that each candidate be given a separate specimen and be permitted to handle and arrange it.

If the specimens named in the Instructions are not available. Supervisors may, with the assistance of the Art Teacher, substitute other specimens as similar as possible to those which have been set. The name of the specimen used must be stated on the back of the drawings in small block capitals.

Sprays, when these are set, must be reasonably large and full and in good condition ; they should be displayed in a vase or bottle and be clearly visible against a plain background. The container must not be drawn.

### **Drawing or Painting from a Living Person**

The Supervisor should avail himself of the services of the Art Teacher for posing the model and for re-posing after the model has been resting.

Five minutes will be allowed for the model to relax after each twenty minutes' posing. During these intervals candidates may continue to work on their drawings. The Supervisors may vary the length of the posing periods and of the intervals at their discretion. The period of 2 or 3 hours includes the time during which the model is resting.

## *Elective Subjects*

Two models must be provided if Alternatives A and B are required by different candidates at the same session. If more than one model is employed for either A or B, this should be stated on the answer envelope.

The model is to be posed in good light and shade. Candidates must be so placed that each has a good view of the pose.

### **Original Imaginative Composition in Colour**

Copies of the Paper are to be given to candidates at least a week before the paper is taken in the examination room and candidates should be instructed to bring their copies of the question paper with them at the time fixed for this paper.

### **'Crafts A'**

At centres where the necessary arrangements can be made, candidates may cut and print from a block in the examination room. Folded and cut-out paper may be used in making designs. Collage may be used.

### **Craftwork**

The specimens of Craftwork should not be despatched to the Council. Pieces of pottery, sculpture or carving must not exceed 1 m in any dimension nor weigh more than 18 kg. Craftwork submitted for one examination must not be submitted for a subsequent one. This paper is to be assessed by a Visiting Examiner appointed locally.

### **SYLLABUS**

Success or failure will depend on a candidate's performance in the subject as a whole. **Three Papers** must be taken, including at least **one paper** from Section A and at least **one paper** from Section B.

Papers 1-3 form Section A. Papers 4-6 form Section B.

**Paper 1** : (2½ hours), DRAWING OR PAINTING FROM STILL-LIFE

A group of objects which will be artificial a natural and may include such things as cut flowers, fruits, vegetables, a growing plant,

as well as domestic or other artificial objects ; the group may be drawn or painted. The work can be carried out, if the candidate wishes, in relation to the surroundings of the part of the room in which the group is placed, If the group is painted, the background must be included.

**Paper 2 : (2½ hours, DRAWING OR PAINTING FROM NATURE**

This paper is divided into two separate section. Candidates may offer either A or B. in both sections, the subject may be interpreted freely, either in a decorative or in a realistic manner.

A. *Study of the structure of natural forms* such as a spray or branch which may include flowers ; foliage or fruit ; fossils, bones, etc. Candidates are expected to reveal their appreciation of natural growth or structure by means of drawing or painting.

B. A subject will be set for drawing or painting outdoors. There should be evidence of direct study from nature.

**Paper 3 : (2 hours), DRAWING OR PAINTING OF A LIVING PERSON**

Two alternatives will be given. In alternative (A) the model (who may be a boy, girl, man or woman) is to be placed in an attitude which will be described. The whole figure must be drawn, together with any necessary artificial or natural objects. If the subjects is painted, the model must be seen against a suitable background. Clothing should be simple and the limbs exposed as much as possible.

Alternative (B) will be mainly a study of the head but may include the arms and hands. Instructions for each examination will be given. Candidates should be placed closer to the model than for Alternative (A).

If candidates consider that they have completed their drawing before the end of the examination period, they may make a separate study. Candidates taking Alternative (A) may choose head, hands, or other details. Those taking Alternative (B) may draw the portrait from another position or make a study of a port of the head or the hands.

## *Elective Subjects*

In either (A) or (B) the second drawing may be made on the same sheet of paper, or on another sheet, which must be attached. Candidates are to be told that the two drawings will be considered together and that marks will not be lost if a second drawing is not attempted.

### **Paper 4 : (3 hours), ORIGINAL IMAGINATIVE COMPOSITION IN COLOUR**

A paper containing a list of alternative subjects will be given to candidates one week before the examination. The actual composition will be executed in the examination room after a period of not less than 7 days from the distribution of the paper to the candidates ; sketches or other notes must be taken into the examination room. Since this is a test of original work, it would be inappropriate for any form of guidance to be given to candidates other than that printed on the question paper. A variety of themes will be set ; these may be given in the form of titles indicating the subjects or of specified objects for inclusion in a composition or in any other form that will simulate the imagination. Candidates should base their work if possible on scenes which they have themselves observed. Any style or technique, including that which is traditional in the candidates' own area, may be used.

### **Paper 5 : (3 hours), CRAFTS 'A'**

Candidates will be required to answer any *one question*. The object of this paper is to test the ability of candidates in craftwork where the material is restricted to flat paper, ink and/or colour. Question will be set requiring the design and execution of the following :

the page of a book, book cover, or end papers :

a notice or pictorial poster ;

a card, such as a Christmas card or invitation card, or emblem ;

a patterned paper for a specific purpose.

Several but not all of these alternative subjects, will be set and candidates will be required to select any one of them. There will be an opportunity to make full use of the calligrapher's art with drawn and painted, pen-made or brush-written lettering.

## **Paper 6 : CRAFT 'B'**

This Paper is restricted to school candidates.

The candidate must submit at least one *and not more than two* examples of Craftwork which he or she has executed during the school year in any one craft from the following eight categories. Further evidence of study in the form of working drawings, small notebooks or photographs may also be submitted. Crafts other than those detailed below cannot be accepted.

- (a) Earthenware or stoneware pottery such as a jug, bowl, dish, vase, or hollowed pottery form, which the candidate has either moulded, hand-built, or thrown on the wheel, and decorated if he so wishes.
- (b) Abstract or figurative sculpture including reliefs. These can be carved, constructed, assembled, cast or modelled in any suitable material.

Candidates must be warned not to submit work in material which is likely to break in transit ; clay must always be fired and modelling in plaster must be supported by strong armatures. Sculpture over 60 cm in any dimension is not acceptable because of difficulties in handling.

- (c) Cloth or rug designed and woven by the candidate on the loom for any specified purpose. When possible this should show experience of spinning and dyeing.
- (d) Cotton, wool, silk, bark cloth, or other material dyed in a pattern as in block-printing, screen-printing, batik, tie and dye etc. The piece should be at least a square metre in area. Blocks should not be sent.
- (e) Embroidery mosaic collage or decorative panels, unframed, but simply and suitably mounted, showing evidence of ability to relate design to media.
- (f) Puppet or marionette (including the type used in shadow plays) representing a specified character or person. It is desirable that the puppets should be made in relation to a play and notes on their particular dramatic use should be included.



### *Elective Subjects*

- (g) Prints in colour or black and white, **from an original wood** or lino block or a monotype. The main work must be clearly labelled and suitably mounted. Blocks need not be sent.
- (h) Example of a local craft made by the candidate. This should be supported by a second entry showing a personal development of this craft.

#### **Each candidate must confine his entry to ONE craft**

The work submitted must be the unaided work of the candidate. It must be accompanied by a statement from the Principal of the school to this effect.

## MUSIC

### Aims

- (a) To encourage creative expression in music ;
- (b) To develop the powers of musical appreciation.

One of the **Three** following syllabuses may be offered :

- (A) Indian Music (Hindustani) (872).
- (B) Indian Music (Carnatic) (873).
- (C) Western Music (874).

### (A) INDIAN MUSIC (Hindustani) (872)

(May not be taken with Western Music or Carnatic Music)

The Syllabus is divided into *three* parts : Part 1 (Vocal), Part 2 (Instrumental) and Part 3 (Tabla). Candidates will be required to offer *one* of the parts of the syllabus.

There will be *two* papers : Paper 1 (Theory) and paper 2 (Practical). Candidates will be required to appear for both the papers from *one* section only. In the Theory paper they will be required to attempt *five* questions in all ; *two* questions from Section A and EITHER *three* questions from Section B (Vocal-Instrumental) OR *three* questions from Section C (Tabla).

### Part 1 : VOCAL MUSIC

Paper 1 : (Theory) Three hours.

A. Explanation and definition of the following :

- (1) Production, transmission and reception of sound ; volume pitch and timbre. Relation between frequency and length of the wire vis-a-vis wire tension.
- (2) Musical sound—Nad, Shruti, Swar, Sthaan, Saptak (Mandra Madhya Tar.) That, Lag, Jati.
- (3) Swaras—Tivra, Komal, Suddha, Prakrat, Vikrit, Vadi, Samvadi, Vivadi, Vakra, Varjya, Grah, Ansh, Nyas.
- (4) Type of Ragas—Odava, Shaadava, Sampoorana, Ashraya,

## *Elective Subjects*

Janak, Janya, Poorva, Uttar, Sandhi Prakash, Shuddha, Chhayalag, Sankirna.

- (5) Forms of Composition—Khyal, Dhrupad, Dhamar, Lakshangeet, Sargam and their divisions into Sthayi, Antara, Sanchari, Abhog.
  - (6) Vernas (Sthayi, Arohi, Avarohi, Sanchari), Alankar, Palte, Alap, Tan, Aroha, Avaroha, Meend, Andolan, Gamak, Kan.
  - (7) Sangit—Two main systems : Divisions of twenty-two Shrutis among seven notes : placement of Swaras on specific Shrutis ; formation of Thats out of Saptak ; classification of Ragas among Thats ; Time-table of Ragas ; relationship between Vadi and time of Ragas.
  - (8) Tal, Matra, Laya-bharnapat, Madhya, Drut, Tali, Khali, Sam, Vibhag, Theka, Aartan, Dugun, Chaugun, Athgun.
- B.** (1) Complete theory of the following Ragas with special reference to their notes, Aroha, Avaroha, Pakad, Vadi, Samvadi, Vivadi time etc. and specific emphasis on their chalan.  
Ansh and Nyas Swaras : Yaman, Bilawal, Kafi, Kamaj, Asawari, Bhairava, Bhairavi, Bhoopali.
- (2) General knowledge of the following additional Ragas :  
Bageshwari, Brindabani, Sarang, Desh, Malkauns.
- C.** Notation of the following Tals, their Thekas, Matras, Vibhags, Talis Khalis, with Dugun and Chaugun.  
Tintal, Chartal, Jhaptal, Dadra, Ektal, Kaharawa, Teevra, Rupak.
- D.** Notation of note combinations, Songs, Gat with Alap, Tan/Toda, Jhal. (Any Indian system of notation can be adopted).
- E.** Identification of Ragas by written note-combinations.
- F.** Comparison and contrast between Raga.
- G.** Brief History of Indian Music.
- H.** Contributions of the following Musicologists/Musicians :  
Amir Khusro, Tansen, Adarang, Vishnu Digambar Bhatkhande, Fiyas Khan, Bade Ghulam Ali Khan, Dagar Brothers, Kesar

Bai, Inayat Khan, Allauddin Khan, Khalifa Nathu Khan, Bire Misra.

- I. Essay of general or topical interest on musical and allied subjects.

**Paper 2 :** (Practical) About 20 minutes

1. Demonstration of the following Ragas by singing or playing Khyal or Gat with complete improvisation—Alap, Ta Bolalap, Bolton, Sargam Tan etc. or Ten Todas with five types of Jhalas :  
Yaman, Bilawal, Kafi, Khamaj, Asawari. Bhairavi, Bhairav Bhoopal.
2. Swar Vistar or Jod Alap in the following additional Raga Bhipalasi, Brindabani, Sarang, Desh, Malkauns.
3. One Bilambit Khyal and one Dhrupad in any of two Ragas mentioned in paragraph 1.

OR

Two Masitkhani Gat or Bilampat Gat in any of the two Ragas in paragraph 1.

4. Identification and production of all the twelve notes individually or jointly in small note combinations with definite Matras of each.
5. Use of grace notes Khatka, Murki, Sparsh, etc.
6. Identification of all the twelve Ragas by listening to their main Alaps.
7. Singing or playing of ten Alankars.
8. Recitation of the following Talis with Dugun and Chaugun speeds showing various divisions by Talis, Khalis, by har Teental, Jhaptal, Dadra, Rupak, Kaharawa, Teevra Dhamar, Ektal.
9. Practice of singing or playing self-made Alaps by quick change-over from one Rag to another in a sequence of at least four Ragas.
10. Practice of rendering Dugun, Chaugun, Tigun, Athgun speeds by swaras, numericals or syllables.

## *Elective Subjects*

11. Practice of singing or playing Arohis and Avarohis of ten principal scales—Thats.

### **Part 2 : INSTRUMENTAL MUSIC (EXCLUDING TABLA)**

**paper 1 :** (Theory) Three hours.

Explanation and definition of the following :

- (1) Production, transmission and reception of sound ; Volume, pitch and timbre. Relation between frequency and length of the wire vis-a-vis wire tension.
  - (2) Musical sound—Nad, Shruti, Swar, Sthaan, Septak (Mandra, Madhya Tar) That, Rag, Jati.
  - (3) Swaras—Tivra, Komal, Shuddha, Prakrat, Vikrit, Vadi, Samvadi, Vivadi, Vakra, Varjya Grah, Ansh, Nyas.
  - (4) Type of Ragas—Odava, Shaadava, Sampoorana, Ashraya, Janak, Janya, Poorva, Uttar, Sandhi Prakash, Shuddha, Chhayalag, Sankirna.
  - (5) Varnas (Sthayi, Arohi Avarohi Sanchari) Alankar, Palte, Alap, Tan, Aroha, Avaroha, Meend, Andolan, Gamak, Kan.
  - (6) Sangit—Two main systems : Divisions of twenty-two Shrutis among seven notes; placement of Swaras on Specific Shrutis ; formation of Thats out of Saptak ; classification of Ragas among Thats ; Time table of Ragas ; relationship between Vadi and time of Ragas.
  - (7) Tal, Matra, Laya-Bilampat, Madhya, Drut, Tali Khali Sam, Vibhag, Theka, Avartan, Dugun, Chaugun, Athgun.
- B. (1) Complete theory of the following Ragas with special reference to their notes : Aroha, Avaroha, Pakad, Vadi, Samvadi, Vivadi, time etc. and specific emphasis on their chalan ; Ansh and Nyas Swaras :  
Yaman, Bilawal, Kafi, Kamaj, Asawari, Bhairava, Bhairavi, Bhoopali
- (2) General knowledge of the following additional Ragas :  
Bageshwari, Brindabani, Sarang, Desh, Malkauns.
- Notation of the following Tals, their Thekas, Matras, Vibhags, Talis, Khalia, with Dugun and Chaugun, Tintal, Chartal.

- Jhaptal, Dadra, Ektal, Kaharawa, Teevra, Rupak.
- D. Notation of note-combinations, Songs, Gat with Alap, Man/ Toda, Jhala. (Any Indian system of notation can be adopted).
- E. Identification of Ragas by written note-combinations.
- F. Comparison and contrast between Ragas.
- G. Brief History of Indian Music.
- H. Contributions of the following Musicologists/Musicians :  
Amir Khusro, Tansen, Adarang, Vishnu Digambar, Bhatkhande, Fiyaz Khan, Bade Ghulam Ali Khan, Dagar brothers, Kesav Bai, Inayat Khan, Allauddin Khan, Khalifa, Nathu Khan, Biroo Misra.
- I. Essay of general or topical interest on musical and allied subjects.
- J. Manner of holding the instrument while playing it.
- K. Explanation/definition of the following :  
(1) Gat, Toda, Bol, Akarsh Prahar (Sulat), Aakarsh Prahar (Ulat), Chal That, Achal That, Razakhani, Masitkhani, Zamzama, Murki, Gatkari, Sparsh, Meend, Soot, Ghasit, Khatka, Krintan, Kampan.  
(2) Baj Ka Tar, Jodi Ka Tar, Chikari Ka Tar, Laraz.Ka Tar, Tarab Ka Tar.
- L. Description of the various parts of the instruments.
- M. Classification of Indian instruments—Tat, Vitat, Ghan, St shir Avanaddha.
- N. Brief history and origin of instrument.

**Paper 2 : (Practical) About 20 minutes.**

This Syllabus is the same as that given for Paper 2 of Section A.

**Paper 3 : TABLA**

- A. Brief History of Indian Music.
- B. Contribution of the following Musicologists/Musicians :  
Amir Khusro, Tansen, Adarang, Vishnu Digambar, Bhatkhande, Fiyaz Khan, Bade Ghulam Ali Khan, Dagar Brothers,

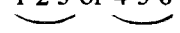
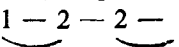
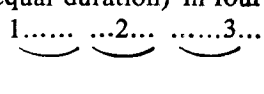
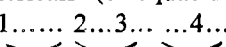
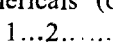
## *Elective Subjects*

Kesar Bai, Inayat Khan, Allauddin Khan, Khalifa Nathu Khan, Biroo Misra.

- C. Essay of general or topical interest on musical and allied subjects.
- D. Manner of holding the instrument while playing it.
- E. Description of the various parts of the instrument.
- F. Classification of Indian instruments—Tat, Vitat, Ghan, Sushir, Avanaddha.
- G. Brief history and origin of instrument.
- H. Technique of producing Syllables on Tabla and Bayan (both sides individually and jointly) and description of relative duration of each Syllable and Wazan.
- I. Ten Pranas of Tal and explanation thereof :  
Kal, Marg, Kriya, Ang, Grah (Sam, Visham, Atit, Anaghat), Jzti (Chatasra, Tisa, Misra, Khand, Sankirna) ; Kaala, Laya, Yati, Prastar.
- J. Explanation of the following :  
Theka, Avartan, Sath, Kism, Tukada, Tiha, (Damdar/Bedam), Mukhada, Mohra; Uthan, Paran, Gat, Kayada, Palta, Rela Laggi, Ladi, Peshkara.
- K. Complete Tal notation of the following Tals :  
Tintal, Jhaptal, Ektal, Chartal, Dadra, Tilwara, Dhamar, Rupak, Tivra, Jhoomra
- L. Dugun, Tigun, Chaugun, Athgun of the Tals.
- M. Tal rotation of Kayada Palta etc. with clear indication of Sam, Tali, Khali, Vibhag, etc.

**Paper 2 :** (Practical) About 20 minutes.

- 1. Playing of the following Tals on Tabla in Thah, Dugun, Chaugun speeds.  
Tintal, Jhaptal, Ektal, Chartal, Dadra, Tilwara, Dhamar, Rupak, Tivra, Jhoomra.
- 2. Keeping up the wazan of the Tal intact, demonstration of the following :  
(a) Four kisme in Teental

- (b) Eight kisme in Kaharawa  
 (c) Four kisme in Dadra  
 (d) Two kisme in Jhaptal
3. Rendering of the following :
- (a) One Peshkara or uthan, for Kayadas and their Paltes in Tintal.  
 (b) Two Tukadas in Jhaptal with full Tihas.  
 (c) One Paran in Chartal or Ektal.  
 (d) One Tiha in Rupak or Tivra.  
 (e) One G. t, one Laggi and one Ladi in Tintal.  
 (f) One Chakkardar Tukada in Tintal.
4. Accompaniment of Tabla (only Thekas) with music played or sung.
5. Identification and production of Syllabus on Tabla.
6. Examples of each of the following in any Tals mentioned in para 1 :  
 Mukhada, Mohra, Rela, Damdar Tiha, Bedam Tiha.
7. Recitation of the following rhythmic patterns showing by hand beat.
- (a) Three syllables/numericals (of equal duration) in the one beat/matra. (Tigun) e.g. 1 2 3 or 4 5 6  

- (b) Three syllables/numericals (of equal duration) in two beats/matras. (Aad) e.g. 1 — 2 — 2 —  

- (c) Three syllables/numericals (of equal duration) in four beats/matras. (Paungum) e.g. 1..... 2... ..3... ..  

- (d) Four syllables/numericals (of equal duration) in three beats/matras. e.g. 1..... 2...3... ..4...  

- (e) Two syllables/numericals (of equal duration) in three beats/matras. e.g. 1...2.....  




## *Elective Subjects*

### **(B) INDIAN MUSIC—(Carnatic) (873)**

(May not be taken with Western Music or Hindustani Music)

There will be *two* papers ; Paper 1 (Theory), Paper 2 (Practical)

#### **Paper 1 : THEORY (three hours)**

*Candidates will be required to answer five questions.*

1. The fundamental technical terms and their meanings. (Ref. South Indian Music Book 1 by P. Sambamoorthy Chap. III pp. 38-48).
2. Principles of Sa, ri, ga, ma, notations as laid down in K.V. Srinivasa Iyengar Music Books and in P. Sambamoorthy's "South Indian Music Series", Significance of symbols commonly used.
3. Raga classification in Carnatic Music. The scheme of the 72 Melakartas. The names of the 12 chakras. Katapayadi Formula and its application.
4. Lakshanas of the following 24 ragas :

1. Todi	2. Saveri
3. Chakravakam	4. Bhairavi
5. Anand Bhairavi	6. Karaharapriya
7. Shri Ranjani	8. (Ritigoula)
9. (Mukhari)	10. Harikambhoji
11. Natakuranji	12. Kedaragoula
13. Sahana	14. Kambhoji
15. (Yadukulakambhoji)	16. Sankarabharana
17. Hamsadhwani	18. Begada
19. Atana	20. (Nata)
21. Purvakalyani	22. Shanmukhapriya
23. Kalyani	24. Saranga
5. Manodharma Sangita and its forms—Paddhati in developing raga alpana and Kalpana Svaras.
6. Dasavida gamakas (Ten gamakas)
7. The scheme of the 35 Talas. Chapu tala and its varieties. Desadi and Madyadi talas. Kriya, Anga, Laya, Gati Matra (a detailed knowledge of two five pranas) shadhangas.

8. Musical forms and their classification. An advanced knowledge of the following Musical forms :
- |              |               |
|--------------|---------------|
| 1. Gita      | 2. Tana Verma |
| 3. Padavarna | 4. Kriti      |
| 5. Ragamlika | 6. Padam      |
| 7. Javali    | 8. Tillana    |
9. History of Carnatic Music with special reference to the following composers and theorists including their biographies and their contributions to Carnatic Music. 10 out of 20 must be known.
- |                             |                          |
|-----------------------------|--------------------------|
| 1. Jayadeva                 | 2. Purandaradas          |
| 3. Ramamatya                | 4. Somanatha             |
| 5. Narayana Tirtha          | 6. Bhadrachala Ramadas   |
| 7. Venkatamakhi             | 8. Kshetrajna            |
| 9. Paidala Guruthy Sastri   | 10. Tyagaraja            |
| 11. Muthuswami Dikshitar    | 12. Syama Sastri         |
| 13. Arunachala Kavirayar    | 14. Gopalakrishna Bharat |
| 15. Svati Tirunal           | 16. Subbaraya Shastri    |
| 17. Veena Kuppayyar         | 18. Mysore Sadasiva Rao  |
| 19. Patnam Subramanaya Iyar | 20. Pallavi Seshayyar    |
10. Classification of Musical instruments into stringed, wind and percussion group. A general knowledge of the structure of the vina, violin, tampuro, gottuvadyam and flute. Tuning of the human voice and the compass of the concert instruments of South India.
11. Musical sound and voice. Pitch. Intensity and timbre. Sympathetic vibration. Resonance. Echoes. Musical intervals. Modal shift of tonic. (Grahahbedam).

**Paper 2 : (Practical about 20 minutes)**

1. Two padas of Kshetrajna. One Ragamalika. Two Tillanas. Two Javalis and the following compositions :

- |                     |                 |
|---------------------|-----------------|
| 1. Todi             | Kaddanna variki |
| 2. Saveri           | Sankari Sankuru |
| 3. Chakravakam      | Etula Brotuvo   |
| 4. Bhairavi         | Neepadamule     |
| 5. Anandha Bhairavi | Nimadi Challaga |

## *Elective Subjects*

6. Karaharapriya	Pakkala Nilabadi
7. Sri Ranjini	Marubalka
8. Harikambhoji	Entharanidaya
9. Natakuranji	Manasuvishaya nata
10. Shana	Rama Ikananu
11. Kambhoji	Koniyadina napai
12. Sankarabharana	Saroja dala netri
13. Hamsadhwani	Vatapi ganapatim
14. Begada	Nadopasana
15. Atana	Ilalo pranatharthi hara
16. Purvi Kalyani	Ninnu Vina gamari
17. Shanmukhapriya	Marivaredikkevaraiya rama
18. Kalyani	Ninnu Vina gati
19. Saranga	Neevada negana

Note : Candidates shall have the option of singing or playing these pieces or other classical pieces of an equal standard.

Candidates shall be expected to know in outline the meaning of at least six songs of the classical composers learnt by them.

2. Alapana of the following ragas :

- |                   |                      |
|-------------------|----------------------|
| 1. Todi           | 2. Saveri            |
| 3. Bhairavi       | 4. Anandha Bhairavi  |
| 5. Mohana         | 6. Kedaragoula       |
| 7. Kambhoji       | 8. Yadukula Kambhoji |
| 9. Sankarabharana | 10. Begada           |
| 11. Kalyani       |                      |

3. Ability (i) to sing Kalpada swara for the songs learnt in Todi, Bhairavi, Kambhoji, Sankarabharana and Kalyani ragas and in Adi and Rupaka talas ;

(ii) to sing or play a given musical passage in sa, ri, ga, ma notation in any of the prescribed 24 ragas ;

(iii) to give swaras for musical phrases sung or played ;

(iv) to recognize ragas from alapanas heard or played ; and

(v) to recognize the talas of unfamiliar songs heard or played.

4. In addition to the individual tests there will also be common ear tests, sight-singing tests and musical dictation at the practical examination.

In the practical examination candidates may offer vocal music or one of the following.

Vina, Gottuvadyam, Violin, Balakokil, Flute or Nagasvaram. A vocal candidate shall sing to the sruti accompaniment of Tambura. A vocal candidate may sing playing the Tambura himself/herself or he/she may utilise the services of another person to provide the Tambura accompaniment for him/her, provided this other person is not a candidate for this same examination.

### (C) WESTERN MUSIC (874)

(May not be taken with Carnatic Music or Hindustani Music)

#### Pre-Requisite.

Candidates for the examination in Western Music will be required to have passed the Practical Examination of the Associated Board of the Royal Schools of Music, Grade 6, or a more advanced grade.

The syllabus will be examined in two parts, namely, Part A : Aural Tests ; Part B : One paper of three hours.

*Part A* : Aural Tests (candidates will be required to write all six Tests).

1. Candidates will be required to write on a monotone, prefixing the necessary time-signature, a short rhythmical passage beginning on the first beat of a bar. Compound time will not be included. After indicating the speed at which the pulse of the music moves, the Examiner will play the passage twice. After a short interval, he will play it a third and a fourth time.

2. Candidates will be required to write from dictation a short melodic phrase, beginning on the first beat of a bar, in either a major or a minor key. Before playing the passage, the Examiner will indicate the speed at which the pulse of the music moves. The key will be named, and the key-note and tonic chord sounded. The phrase will then be played once throughout. It will then be played twice in sections, at short intervals of time, and finally the phrase will be repeated in its entirety.

## *Elective Subjects*

3. Candidates will be required to describe (e.g. 'perfect 5th') intervals which are diatonic in major keys. Two such intervals will be given without the sounding of the key-notes. Each interval will be played twice.

4. Candidates will be required to recognize and name any of the following cadences—perfect, imperfect (half-close), plagal, interrupted—occurring in a musical example in a major or a minor key played by the Examiner. After the tonic chord has been sounded, the whole musical sentence will be played through three times, with due deliberation, at short intervals.

5. Candidates will be required to recognize the three principal chords of a major or a minor key (in root position and in first and second inversion) as played by the Examiner in a continuous musical phrase in a definite key. The phrase containing the given chords will begin with a chord in root position. It will be played *four* times at a reasonably slow pace, and before each playing the tonic chord will be sounded.

6. Candidates will be required to recognize and name simple changes of key. Three examples will be given, each starting from the same tonic key, and containing one modulation only. Modulations will be limited to the dominant, sub-dominant, and relative major or minor keys. After the key has been named and the tonic chord has been sounded, each of the three examples will be played through twice.

The test will not necessarily contain examples of modulations to three *different* keys ; the same key may recur.

A candidate will be at liberty to write down his answers to a particular test at any stage.

*Part B* : (One paper of three hours)

### SECTION A

*Candidates will be required to answer five questions : two from Section A, two from Section B and the remaining question from either Section A or Section B.*

(i) *Harmony, etc.*

Four-parts chords formed on all degrees of major and minor scales. First the second inversions, the dominant seventh chord and

its inversions, modulation to related keys, and the simple use of unessential notes. The tests may take the form of harmonization of a melody in four vocal parts or in simple pianoforte style, the working of a figured or unfigured bass, or the construction of a phrase on a given harmonic basis.

The addition of a melody, above or below a given melody, the writing of a melody to given words, or the completion of a melody of which the beginning is given.

Analysis of the rhythmic structure of a melody, phrasing, etc. Analysis of harmonic progressions including modulations, in a straightforward passage.

## SECTION B

Prescribed Works :

Beethoven, *Symphony No. 2 in D major* op 36 and one of the following :

- (a) Bach, *prelude and fugue No. 16 in G minor* Book I.
- (b) Schubert "*Erl Kenig*" (The Erl King).
- (c) Caesar Frank : the last movement from the Violin and piano senata.

## PHYSICAL EDUCATION (875)

### Aims

- (a) To create awareness of the necessity for organic vigour and efficiency through physical fitness.
- (b) To develop knowledge and understanding of the requirements of healthy living, nutrition, exercise and relaxation.
- (c) To create awareness of the necessity to develop a good posture and physical poise.
- (d) To develop knowledge and understanding of skills that will be useful as leisure time activities and those of a recreational nature.
- (e) To create opportunities to develop esprit de corp, courtesy sportsmanship, social skills, democratic conduct and ideals.
- (f) To develop appreciation of the aesthetics and cultural aspects of movement.

There will be **one** theory paper of three hours duration and a Practical Test.

The theory paper will be divided into two sections as follows :  
Section A will contain six compulsory questions ; Section B will contain two questions based on each major game to test the practical experience of the candidates in **two** games of their choice.

### 1. Sociological Aspects of Physical Education :

- (a) Games and sports as man's cultural heritage
- (b) Development of the individual through games and sports
- (c) Role of Physical Education in promoting national integration, development of attitudes, helpfulness, tolerance, patience, team spirit and unity etc.

### 2. Physical Education :

- (a) Theories of Play
- (b) Interest and attitude
- (c) Motivation
- (d) Leadership

**3. Training Method :**

- (a) Warming up and conditioning
- (b) Isometric exercises
- (c) Isotonic exercises
- (d) Circuit training
- (e) Interval training

Leadership training in Physical Education. Its importance and facilities available in India.

**4. Officiating and Coaching .**

Candidates to be fully aware of Rules of sports and games and their interpretation—Tournaments—Trophies and Personalities connected with them. Olympic Movement—Difference between Professional and Amateur. Modern trends and above all role of Physical Education in building the all round personality of an individual.

**5. Health Education :**

Principles of Health Education, Importance of Health Education for adults and the younger generation through formal and non-formal channels of education. Health problems and role of Health Education in solving them.

Prevention of Disability and Rehabilitation ; Disability and Rehabilitation ; General Principle of Prevention of Disability ; Meaning and Scope of Rehabilitation ; Services available for rehabilitation and role of the community in rehabilitation.

Correct posture, personal cleanliness, recreation, foot care, sleep requirements. Dangers of misuse of drugs. Dangers of alcohol and smoking.

**6. General :**

Study of the human skeleton ; various systems and their effect ; muscular, circulatory, respiratory, digestive, nervous and endocrine systems.

**7. Nutrition : Weight control and exercise :**

Nutrition basics : dietary goals and basics for a Nutritious diet. Overweight and obesity. Role of exercise in weight control, plan for losing weight ; lifetime concept of weight control





jump when ready. After making a preliminary swing with the arms the candidate swings them forward vigorously, springing with both feet simultaneously to land as far forward as possible. Distance jumped to be measured in centimetres.

(c) *Test 3*

Distance run-1000 metres run for boys 600 metres run for girls. Time to be taken to the nearest second.

(d) *Test 4*

- (i) **Floor push-ups for boys.** The boy takes a front-leaning position with body supported on hands and balls of feet; the arms are straight and at right angles to the body. He then dips or lowers the body so that the chest touches or nearly touches the floor, then pushes back to the starting position by straightening the arms and repeats the procedure as many times as possible. Only the chest should touch the floor, the arms must be completely extended with each push-up; the body must be held straight throughout. Scoring consists of the number of correct push-ups.
- (ii) **Push-ups for girls.** This is executed from a stall bar bench or a stool 32 cm high by 50 cm long and 35 cm wide. It should be placed on the floor about 15 cm from a wall so that subjects will not take a position too far forward. The girl should grasp the outer edges of the bench, or stool, at the nearest corners and assume the front-leaning rest position, with the balls of her feet on the floor and with her body and arms forming a right angle. She should then lower her body so that the upper chest touches the near edge of the bench or stool, then raise it to a straight arm position as many times as possible. The girl's body should be held straight throughout. If the body sways or arches, or if the subject does not go completely down or does not push completely up, half credit is given up to 4 half credits.

(e) *Test 5*

Shuttle run. A flat course of 10 metres is required to be measured between two parallel base lines. Behind each base line a semicircle 50 cm radius with centre on the base line is required to be

## *Elective Subjects*

marked. In the far semicircle two wooden blocks ( $5 \times 5 \times 5$  cm) are to be placed. The candidate stands with feet behind the base line, and on a signal, runs to the far line, picks up one block which the candidate places in the starting semicircle when he/she returns. The candidate then repeats the procedure with the second block. The time to the nearest tenth of a second is to be taken till the second block is grounded in the starting semicircle.

### (f) *Test 6*

60-second sit-ups. The candidate lies with his/her back on a mat or flat surface, feet about 30 cm apart and knees flexed at a right angle. The candidate's hands with fingers interlocked are placed behind the back. A partner holds the candidate's feet in contact with the mat or floor. On the signal "Go" the candidate sits up to touch the knees with his/her elbows. Without pause he/she returns to his/her starting position and immediately sits up again. The number of sit ups completed in 60 seconds are to be counted.

## ISC (YEAR-12)

## PERFORMANCE TABLE-PHYSICAL EDUCATION - PHYSICAL EFFICIENCY TESTS

Marks	Test No. 1		Test No. 2		Test No. 3		Test No. 4		Test No. 5		Test No. 6	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
	50 m dash (Timing in seconds and tenths)		standing long jump (Distance in (cm))		Distance run (Timing in min. and s)		push-ups (Numbers)		Shuttle run (Timing in seconds and tenths)		60 s sit-ups (Numbers)	
5	6.5	7.6	204	167	4 min 40 s	2 min 45 s	30	22	9.8	11.0	47	30
4	6.6	7.9	197	155	4 min 50 s	2 min 55 s	24	14	10.0	11.2	44	28
3	6.6	8.2	190	149	5 min	3 min 15 s	17	8	10.2	11.6	41	26
2	7.1	8.4	183	142	5 min 10 s	3 min 35 s	10	6	10.6	11.9	37	24
1	7.5	8.9	175	132	5 min 30 s	4 min 15 s	6	3	11.1	12.1	32	20

**\*Note :** For timings and distances in between or lower than those indicated in the table the lower mark should be given.

**SPECIALISATION : SKILL ANALYSIS MAJOR GAMES  
(FUNDAMENTALS)**

Practical work will be assessed in two parts as follows :

1. The skill and performance of the candidates will be assessed by the teacher(s) responsible for preparing candidates for the examination, in two of the following games and activities of their choice :  
Athletics, Cricket, Hockey, Football, Volleyball, Softball, Basketball, Tennis, Badminton, Swimming, Dancing, Gymnastics, Yoga.
2. A Visiting Examiner will be appointed with the approval of the Council. The assessment of the work of the candidates by the Visiting Examiner is in two parts :  
(i) Physical Efficiency Tests (ii) Specialisation Tests.

**SKILLS MAJOR GAMES**

**CRICKET :**

**Batting :** Pull, Cut, Hook, Glance, stepping out to drive the flighted ball.

**Bowling :** Outswing, Inswing, off break, leg break and googly.

**Fielding :** Catching high and low and ground balls.

**HOCKEY :**

**I. Straight Hitting and stopping :**

- (a) Reverse hitting and stopping
- (b) Hitting on the wrong foot

**II. Straight push and stopping**

- (a) Reverse push and stopping
- (b) Pushing on the wrong foot

**III. Scooping :**

- (a) Pust scoop
- (b) Shovelling

**IV. Flick :**

- (a) Straight flick
- (b) Reverse flick
- (c) Flick on the wrong foot

**V. Dribbling and carrying the ball :**

**VI. Passing :**

- (a) Through pass
- (b) Return pass
- (c) Deflection pass
- (d) Inter changing position

**VII. Dodging :**

- (a) Dodging to opponent's left
- (b) Dodging to opponent's right
- (c) Double dodging

**VIII. Different Technique of :**

- (a) Corner
- (b) Penalty stroke
- (c) Push in
- (d) Goal keeping

**IX. Tackling :**

- (a) Lunging
- (b) Feinting

**FOOTBALL**

**1. Passing and Interpassing :**

- (a) Inter passing between two players
- (b) Inter passing among three players
- (c) Three man weave
- (d) Inter-passing among 4 players
- (e) Related practices

**2. Kicking :**

- (a) Revision of all kicking fundamentals
- (b) Lofted kicks with either foot
- (c) Practise of corner kicks-lobbing chip shots and penalty kicks.

**3. Tackling :**

- (a) Interception and hasty tackles
- (b) Sliding tackles
- (c) Related practices

## ***Elective Subjects***

### **4. Heading :**

- (a) Related practices, front, right side and left side.
- (b) Head up drills.

### **5. Dribbling :**

Practice of dribbling skills suited to actual playing situations

### **6. Tactics and coaching :**

- (a) Two Back system-Three Back system
- (b) Principles of Zone and Man to Man defence
- (c) Free kicks-penalty kicks, corner kicks
- (d) Tactics of Defence and Attachment.

## **BASKETBALL SKILLS :**

### **1. Ball handling :**

Holding position of fingers, body, position, stance of player with ball.

### **2. Catching the ball ;**

(Receiving) skills involved

### **3. Passing :**

Skills—(Drills in Pairs)

- (a) Two handed chest pass
- (b) Two handed bounce pass
- (c) Two handed under hand pass (Right/left side)
- (d) Two handed over head pass.

### **4. Dribbling :**

Dribbling high with speed, using alternate hands, low dribble.

### **5. Shooting :**

- (a) Two handed set shot
- (b) Two handed free throw
- (c) Lay up shot following dribble using right and (over the shoulder lay up)

### **6. Footwork :**

Player stance, position of feet, position of hand, elementary shuffling and slicing movements (drills)

**7. Pivoting Stationary Pivot :**

**8. Individual defence ;**

Player stance : position of hands, position of feet, defender's position in between opponent and basket.

**9. Team defence :**

Man to Man defence

**10. Team offence :**

First Break offence

**11. Full Court ;**

Half court game using defence, offence taught.

**VOLLEYBALL**

**Skills :**

**1. The Pass :**

- (a) Over-head pass : Two handed pass with back rolling
- (b) Two handed pass with side rolling
- (c) Jump and pass
- (d) Under arm pass
- (e) Forward dive and pass
- (f) One arm pass with side rolling:

**2. The Serve :**

- (a) Over head service (Tennis)
- (b) Round arm service
- (c) Floating Service (overhead and arm)

**3. The Set-up :**

- (a) Setting up for quick smash
- (b) Move and set up (From back zones)
- (c) Setting up to different zones at varying trajectories

**4. The Net Recovery :**

- (a) Two handed over head pass without rolling, one hand under arm with and without rolling.

**5. The Attack :**

- (a) Smash with turn of body
- (b) Smash with turn of wrist



## *Elective Subjects*

- (c) Round arm smash
- (d) Smash on short pass (ascending balls)
- (e) Simple attack combination.

### **6. The Block ;**

- (a) Double block against different types of attack
- (b) Double block in assigned zones
- (c) Double block against quick attack
- (d) Double block against attack combination
- (e) Triple block against attack from zone.

### **7. Patterns of play :**

- 4-2 system
- 5-1 system.

### **N.B.**

1. (a) While the skills of Major Games should be taught, the teacher in charge may kindly impress upon the candidates the Rules and Regulations of Tournament (National and International) ; Trophies connected with such tournaments and also personalities connected should be mentioned.
  - (b) Organisation of Olympics, Asian Games and Commonwealth games and the countries usually participating in them should be mentioned.
  - (c) Various terms and terminologies connected with each game should be clearly defined.
2. While testing the candidates in major games, the following method should be adopted. Test of the skill as a whole with emphasis on
- (a) Approach
  - (b) Stance/Grip
  - (c) Execution (degrees of perfection) and
  - (d) follow through.

## **SKILL ANALYSIS --ATHLETICS SPECIALISATION (FUNDAMENTALS)**

### **SPRINTS :**

- (i) Practice of starts with blocks using proper command.

- (ii) Time action period—Reaction time, block clearance time, acceleration time, velocity maintenance time, finish time.

### MIDDLE DISTANCE AND LONG DISTANCE RACES :

- (i) Style of endurance Running
- (ii) Methods of Endurance development

<b>Broad jump</b>	<b>Hop, Step and Jump (Triple Jump)</b>
(i) Approach run	(i) Approach run
(ii) Take off	(ii) Take off
(iii) Flying Phase	(iii) Performance of hop, step and jump.
(iv) Landing	(iv) Performance of combination of hops and steps for developing.

### High Jump

- (i) Approach run
- (ii) Take off
- (iii) Flying phase : scissors, straddle, western roll or "Fosbury flop"

### Pole Vault (Boys only)

- (i) Grip
- (ii) Pole carry
- (iii) Approach run
- (iv) Take off
- (v) Planting of Pole
- (vi) Clearance of bar
- (vii) Landing

### Discuss Throw :

- (i) Stance
- (ii) Preliminary Swings
- (iii) Throws with one and a half turn
- (iv) Reverse

### Javelin Throw :

- (i) Grip
- (ii) Javelin carry
- (iii) Transition from approach to five stride rhythm.
- (iv) Release
- (v) Reverse

### Shot put

- (i) Stance
- (ii) Glide
- (iii) Release
- (iv) Reverse

## SPECIALISATION TESTS

Candidates will be tested by the teacher deputed to conduct the examination in Class XI and in the presence of a Visiting Examiner in Class XII in one of the following activities listed below :

- (a) Athletics
- (b) Gymnastics
- (c) Swimming
- (d) Dance
- (e) Yoga

## Elective Subjects

- (a) *Athletics* : The candidates will choose *two* of the following events in which they wish to be tested :
- (i) Track events—sprints, middle and long distance races  
Boys—100 m, 200 m, 400 m, 800 m, 1500 m and 3000 m  
Girls — 100 m, 200 m, 400 m and 800 m.
  - (ii) Track events—hurdles.  
Boys—110 m and 400 m  
Girls—100 m.
  - (iii) Field events—jumps and throws  
Boys—Broad jump, high jump, triple jump, pole vault, shotput, discus throw, javelin throw, hammer throw  
Girls—Broad jump, high jump, shot put, discus throw
- (b) *Gymnastics* : The candidates will be tested in *four* exercises using any *two* of the following bits of apparatus of their choice :
- (i) Floor exercise  
Boys—handspring to front somer-sault (tucked) ; two head-springs, cartwheel to arabesque ; arab spring ; side somersault ; back roll to handstand ; cabriole jump throw ; flic-flacs.  
Girls—Leap and cabriole ; step onto ball of either feet ; flic-flacs ; round off ; hand spring ; cat leap ; legs split in air ; cartwheel ; handstand.
  - (ii) Balancing Beam (Girls only)  
Run 2-3 steps ; leap to riding seat with  $1/2$  turn ; rise to squat stand ; ballet stand with  $1/2$  turn ; leap on either feet ; step forward leap changing legs to rear leap ; lunge to side ; stag leap ; one-arm cartwheel.
  - (iii) Parallel bars—(Boys only)  
Swing forward and cast to upper arm hand ; forward roll ; pirouette forward ; lower to upper arm hand ; swing backward, straddle forward to support (hold).
  - (iv) Vaulting horse  
Boys—(long horse) Split vault ; through vault ; hand stand with cart wheel ; cart wheel and hand spring.

Girls—Astride vault : split vault : through vault ; hand spring.

- (v) Horizontal bar—(Boys only)

Forward and backward giant swings : change of grip : twists : the hip-circles.

- (c) *Swimming* -The candidates will be tested in any *two* of the following events of their choice :

Boys—Free style—100 m, 200 m, 400 m, 800 m

breast stroke—100 m and 200 m

Diving—forward dive, backward dive, reverse dive and inward dive.

Girls—Free style—100 m, 200 m

breast stroke—50 m and 100 m

back stroke—50 m and 100 m

butterfly stroke—50 m and 100 m

Diving—Forward dive, backward dive, reverse dive and inward dive.

- (d) *Dancing* The candidates will be required to give a performance of any *two* of the following dances of their choice, with suitable accompaniment :

(i) Indian dancing : Bharatanatyam, Kuchipudi, Kathakali, Kathak, Manipuri, Odissi, Mohiniyattam Bhangra and other folk dances.

(ii) Western dancing : Ballet : ball room dancing-waltz, foxtrot, tango, samba, charleston, square dancing : pop-dancing-jitterbug, twist, rock-an-roll.

- (e) *Yoga* :

The candidates will be tested in any **four** of the following asanas :

(i) Vrikshasana (Balancing on one leg with the other flexed sideways).

(ii) Utitha Trikonasana (Feet apart stand, side bending).

(iii) Parivrtta Trikonasana (Feet apart stand, side bend with the trunk rotated backward).

(iv) Utitha parvakonasana (Feet apart stand lunging on one side).

## *Elective Subjects*

- (v) Purivrita Parvakonsana (Feet apart stand lunging on one side and rotate the trunk backwards).
- (vi) Virabhadrasana (Balancing on one leg with stretched hands, trunk and legs in a horizontal position).
- (vii) Uthitha Hasta padangusthasana (Balancing on one leg and trunk bending over the other stretched horizontally).
- (viii) Parsuottansasen (Feet apart stand and turning one side and bend the trunk over the knee on that side).
- (ix) Ushtrarsan (kneel sit and flex back the trunk).
- (x) Padakastasan (Attention position, flex and trunk over the things).
- (xi) Garudasan (Balancing one leg with the other turned over the former).
- (xii) Navasrna (Balancing on buttocks with the legs and trunk flexed over each other).
- (xiii) Vajrasana (Sitting with flexed legs feet on the side of buttocks).
- (xiv) Supta Vajrasana (supine lying in the position of Vajrasana).
- (xv) Kukkutasana (Balancing on hands inserted through the thighs and legs in padmasana).
- (xvi) Jansirasana (Paschimattawasana on one leg with the other leg flexed sideways).
- (xvii) Ardha Baddha Padma Paschimattanasana (Paschimattanasana on one leg with the other in Padmasana position).
- (xviii) Triang Mahaikapada Paschimatanasana (Paschimottanasana on one leg with the other in Najrasana position).
- (xix) Moridriasna (long sit with one knee flexed and kept up and trunk turned over the stretched leg).
- (xx) Akanrava Dhannrasana (Long sit and pull one foot to the corresponding ear).
- (xxi) Uparrshta Konasana (Long sit with feet spread and bring the head to the ground).
- (xxii) Padmasana in Shirasana Nirlambha Sarvangsana (Shoulder stand with hands on thighs).

- (xxiii) Baksana (Balancing on hands with thighs over the arms above elbows).
- (xxiv) Chakrasana (Cartwheel position).
- (xxv) Nowli (contracting rectii abdominal in uddiyana position alternate relaxation and contraction of left and right muscles in quick succession).
- (xxvi) Kapalabathi (Quick succession of abdominal strokes in padmasana position).
- (xxvii) Bhastrika (Pranavam following the strokes of Kapalabathi).

**PERFORMANCE TABLE--PHYSICAL EDUCATION SPECIALISATION TESTS**  
**ATHLETICS—FIELD EVENTS**

Marks	Long jump (m and cm)		High jump (m and cm)		Hop step and jump (m and cm)	Pole vault (m and cm)	Shot put (m and cm)	Discus throw (m and cm)	Javelin throw (m and cm)	
	Boys	Girls	Boys	Girls	Boys	Boys	Boys	Girls	Boys	
10	5.50	5.00	1.70	1.50	12	3.00	10	8.50	25	35
8	5.00	4.50	2.55	1.45	11.50	2.75	9	7.50	22	22
6	4.50	4.00	1.40	1.40	11.00	2.25	8	6.50	19	29
4	4.00	3.50	1.25	1.30	10.50	2.00	7	5.50	16	26
3	3.50	3.00	1.10	1.20	10.00	1.75	6	4.50	13	23
2	2.00	2.50	0.95	1.10	9.50	1.50	5	3.50	10	20
1	2.99	2.00	0.94	1.00	9.49	1.25	4.99	3.49	9.98	19.98

**PERFORMANCE TABLE-PHYSICAL EDUCATION-SPECIALISATION TESTS**  
**ATHLETICS-TRACK EVENTS**

Marks	100 m (s and tenths)		200 m (s and tenths)		400 m (s and tenths)		800 m (s and tenths)		1500 m (min and s)
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
10	11.5	13.6	25.0	24.0	56	68	2.10	2.45	4.40
8	11.5	14.4	25.1	14.1	56.1	68.1	2.10	2.45	4.40
6	12.4	15.2	26.1	27.1	58.1	71.1	2.20	2.55	4.50
4	13.2	10.0	27.1	30.1	60.1	74.1	2.30	3.05	5.00
3	14.0	10.8	28.1	33.1	62.1	77.1	2.40	3.15	5.10
2	14.8	17.6	29.1	36.1	64.1	80.1	2.50	3.25	5.20
1	15.6	18.5	30.1	39.1	66.1	83.1	3.00	3.35	5.30



**PERFORMANCE TABLE - PHYSICAL EDUCATION SPECIALISATION TESTS  
SWIMMING**

Marks	50 m free style (s and tenths)		100 m free style (min and s)		200 m free style (min and s)		400m free style (min and s)	50m breast stroke (min and s)	75m breast stroke (min and s)	100m breast stroke (min and s)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Boys	Girls	Girls	Boys
10	45.0	55.0	1:30	1:50	3:00	3:40	<b>6:00</b>	1:05	1:20	2:00	2:15
9	46.3	56.3	1:32.5	1:53	3:05	3:46	<b>6:10</b>	1:07	1:22.5	2:03.5	2:17.5
8	47.5	57.5	1:35	1:55	3:10	3:50	<b>6:20</b>	1:10	1:25	2:07.5	2:20
7	50.6	60.0	1:40	2:00	3:20	4:00	<b>6:40</b>	1:12	1:27.5	2:10.5	2:25
6	52.5	62.5	1:45	2:05	3:30	4:10	7:00	1:15	1:30	2:15	2:30
5	55.0	65.0	1:50	2:10	3:40	4:20	7:20	1:17	2:32.5	2:18.5	2:35
4	57.5	67.5	1:55	2:15	3:50	4:30	7:40	1:20	1:35	2:22.5	2:40
3	58.7	68.7	1:57.5	2:17.5	3:55	4:35	7:50	1:22	1:37	2:25.5	2:42.5
2	60.0	70.0	2:00	2:20	4:00	4:40	8:00	1:24	1:39	2:28.5	2:45
1	61.2	71.2	2:02.5	2:22.5	4:00.5	4:45	8:10	1:26	1:41	2:30.5	2:47

\*Note : For timings in between or lower than those indicated in the table the lower mark should be given.

**PERFORMANCE TABLE-PHYSICAL EDUCATION-SPECILISATION TESTS**  
**SWIMMING (CONTINUED)**

	Marks 50m back stroke (min and s)		75m back stroke (min and s)		100m back stroke (min and s)		50m butterfly stroke (min and s)		75m butterfly stroke (min and s)		100m butterfly stroke (min and s)		Diving  Description of action
	Boys	Girls	Girls	Boys	Boys	Girls	Girls	Boys	Boys	Girls	Girls		
10	0:55	1:10	1:45	2:00	0:55	1:05	1:37.5	1:50	Vertical, erect body, arms and legs together				
9	1:00	1:15	1:52	2:20.5	0:57	1:10	1:45	1:52.5	Poor angle (either backward or forward).				
8	1:02.5	1:17.5	1:56	2:05	1:00	1:12.5	1:49	1:55	.....				
7	1:05	1:20	2:00	2:10	1:02.5	1:15	1:53	2:00	Poor angle opening of arms in front, side etc.				
6	1:07.5	1:22.5	2:05	2:15	1:05	1:17.5	1:58	2:05	Poor angle opening of arms and legs				
5	1:10	1:25	2:07.5	2:20	1:07.5	1:20	2:01	2:10	Poor angle, opening of arms and legs and flight				
4	1:12.5	1:27.5	2:11	2:25	1:10	1:22.5	2:04	2:15					
3	1:14	1:29	2:14	2:27.5	1:12.5	1:24	2:07	2:17.5					
2	1:15	1:15	2:16	2:30	1:14	1:25	2:09	2:20					
1	1:16	1:31	2:18	2:32.5	1:16	1:26	2:11	2:25					

\*Note: For timings in between or lower than those indicated in the table the lower mark should be given.

## SOCIALLY USEFUL PRODUCTIVE WORK

**Extract** from 'Learning to Do' Towards a Learning and Working Society. Report of the National Review Committee on Higher Secondary Education with special reference to vocationalisation.

*The objectives, sample plan of work and the mode of operations of the part of the curriculum (SUPW) to be executed by the teachers and the students are briefly set forth in the following paragraphs.*

1. Socially useful productive work (SUPW) which is of a practical nature and undertaken under appropriate supervision and planning, will help achieve, inter alia, the following objectives :—

- (a) Inculcation of positive attitudes to work in the students ;
- (b) Identifying themselves with the community by rendering Social and Community Service ;
- (c) Development of the habit of co-operative work ;
- (d) Making the community conscious of scientific advancements and help it develop a scientific outlook ;
- (e) Learning to apply one's classroom and vocationalised knowledge to solve day-to-day problems of the community ;
- (f) Participation in nation building activities ; and
- (g) Realization of the goals of the State and national development.

2. To develop the proper attitude towards rural development and community service, the pupils at the higher secondary education level must be provided motivation and training opportunities. They should be given orientation training for 4-5 days in social service, understand its meaning, method and outcomes, and the means of developing rapport with the local community. The connected people, in the fields in which the pupils are interested, can be brought to the school campus to address and motivate the pupils. The Heads of the higher secondary schools can be trained in different areas and they can train their teachers in their own schools in motivating the pupils, planning the programmes, carrying out and evaluating them. The

teachers should be 'all purpose' guides for the effective participation of pupils in the programme.

3. The Project areas for SUPW can be selected according to the convenience of each school, its location, rural or urban, its background and experiences. More particularly the selection of the area will depend on :—

- (a) Nearness of the area to the school ;
- (b) Co-operation of the selected community ; and
- (c) Understanding the locally available programme.

While selecting the area, the teachers should understand the extent of co-operation of the community and its interest in the welfare programmes. The project area should be one where resources for the activities can be easily mobilised, because the school and pupils cannot spend on transport or expensive programmes. Simple projects can be taken up by the pupils with the available resources and which are within the capacity of the pupils involved. The participation of the local people in all stages of the programme, is a must for the success of the programme.

4. In planning a programme, the following decisions are important : What is to be done, who will do it for what it is, when and how it will be done. If the planning is to be successful, all the following components must be considered :—

- (a) Baseline survey and locating needs and resources.
- (b) Giving priorities to the needs.
- (c) Outlining the programme.
- (d) Conducting the programme.
- (e) Concluding the programme.

A simple survey should be conducted by the pupils in their selected project areas, to help them to understand the needs of the people, the resources available in the area, and decide what could be done by them. With the help of all the teachers in the school, and based on the needs of the people, programmes can be outlined for the specified period of work (two years) in the community. Annual work plans can be prepared by the teachers as a guide post for both teachers and students. A sample plan on a savings campaign could be :

**A Sample Plan of work (Savings Campaign)**

<i>Week</i>	<i>Purpose</i>	<i>Methods to be adopted</i>	<i>Persons Involved</i>	<i>Place</i>
I	Contacting the village leaders and people.	Home visits.	Pupils, teachers and local leaders.	Individual houses.
II	Baseline—survey to learn the income and expenditure and savings pattern in the area.	Interview Home visit.	Homemakers, teachers and pupils.	Individual houses.
III	—do—	—do—	—do—	—do—
IV	Introduce the need and method of savings	Group meeting, charts, posters and exhibits.	People, District Savings Officer. Pupils and teachers.	Community hall or School
V	Explaining various methods of savings.	Home visits. Group discussion with charts and pamphlets.	Pupils and teachers Gram Sevikas & Gram	Individual houses.
VI	Helping them to reach the post Office.	Field visit, Discussion. Demonstration.	Post master, leaders in the community, pupils and teachers.	Post Office.
VII	Educating the people on Bank Saving.	Lecture-cum-Discussion.	Representative from neaby bank, pupils and teachers.	School.
VIII	Helping people to go to the Bank and open Savings accounts.	Field Visit, Discussion.	Interested people, Bank Manager, pupils and teachers.	Bank.
IX	Educating the people in economic improvement programmes.	Lecture-cum-Discussion.	Small Scale Industries Officer, Pupils and teachers.	Community Hall.
X	Starting simple income generating programmes	Demonstration.	Pupils teachers concerned, people.	Community Hall and individual houses.
XI	Follow-up (continued).	All methods and techniques.	Concerned people	Appropriate places.

5. Utilisation of available infrastructure for the planning, execution and evaluation of the programmes is important in order also to minimise the expenditure and effort. The teachers should know the infrastructure available and be aware as to how to make use of them for the success of the programme. The infrastructure available for the welfare of the community are :

1. District Collectorate.
2. Panchayat Union.
3. Village Panchayat.
4. Elementary School.
5. Primary Health Centre.
6. Municipality.
7. Small Savings Organisation.
8. Field Publicity Office.
9. Sarvodaya Sangh.
10. Local Organisation such as Parent Teachers Association and Service Clubs—such as, Rotary, Lion's and Jaycees and others.

To get the assistance and co-operation of those who make up this infrastructure, they should be apprised and involved at all the stages of the programme development—from the planning, through execution to evaluation.

6. The programmes selected must be suitable to the age level and competencies of the pupils and the needs of the community. Both general types of productive programmes and specific productive projects related to the subject matter of each student can be undertaken. The following general programmes can be undertaken by all the pupils irrespective of their subjects (electives) of study :—

- (a) Fact finding.
- (b) Tree Planting.
- (c) Cleanliness and Sanitation.
- (d) Deepening ponds, construction of contour-bounds, community halls, road laying.
- (e) Small Savings Drive.
- (f) Health and Nutrition Education.
- (g) Celebration of national days and festivals.
- (h) Organising film shows.
- (i) Organising libraries/book banks and mobile laboratories.
- (j) Hospital work.
- (k) Conducting programmes in balwari (games and music).
- (l) Coaching children.
- (m) Adult literacy.
- (n) Camps in the adopted area.

Students who are pursuing language studies should take up **Adult Education under Socially Useful Productive Work.**

7. The socially useful productive work should, as far as possible, be allied to the electives chosen by the students, allowing also for any other kind of work depending upon the facilities available in the neighbourhood. The students who are studying Home Science may, for instance, work with the community for improvement of the nutritional status of the population, utilising the local products for developing cheap and wholesome diets. The students of Chemistry may undertake useful work of soil fertilisers and water, removal of pollution, utilisation of wastes, etc. Those of Physics may similarly work on rural electrification, improvement of small and cottage industries etc. Biology students may serve in primary health centres and promote other health measures or help farmers, horticulturists etc., for improving productivity. Political Science students may work with Panchayat Administration, local bodies etc., for purpose of improving various services to the community.

The above are illustrations of the kind of Socially Useful Productive Work which the students, pursuing academic studies, may undertake. Obviously, there are many more areas which can be tackled in one's own environment. A list of some subject-matter related activities is set forth :—

**(1) Indian Languages**

- (i) Writing short stories and skits.
- (ii) Developing leadership qualities through elocution debates.
- (iii) Developing artistic tendency—painting drawing and other fine arts.
- (iv) Promoting national integration.
- (v) Encouraging them to read newspapers—knowledge about current affairs.
- (vi) Adult literary and adult education.
- (vii) Coaching school children.

**(2) History**

- (i) Dramatisation Programmes.
- (ii) Screening Historical films.
- (iii) Publication of Historical Leaflets and Booklets.
- (iv) Organisation of Exhibitions of Historical value.
- (v) Debates and Oratorical competitions as regards the political set up of the country.

- (vi) Discussions and utilisation of local resources.
- (vii) Encouraging the pupils to adopt such hobbies of educational value.

**(3) Geography**

- (i) Radio broadcasts on weather conditions.
- (ii) Making the villagers understand the radio broadcasts.
- (iii) Working models of volcanoes and earthquakes.
- (iv) Survey work of the lands and roads.
- (v) Attending the Panchayat Union Meetings and discussions.

**(4) Mathematics**

- (i) Encouraging the pupils to learn mathematics by pointing out its use in the world at present.
- (ii) Helping the adults and unemployed to run a co-operative store selling goods at controlled price.
- (iii) Teaching them to make toys with simple models like triangles, spheres etc.
- (iv) Helping them to discriminate between British units, and metric system.
- (v) Helping them to be aware of the units and measurements so that they cannot be cheated in shops. This can be done by actually showing the weights, scales and metrescale.

**(5) Physics**

- (i) Giving basic knowledge about how to prevent electric shock accidents.
- (ii) Giving knowledge about how lightning and thunder occurs and what are the uses of lightning and thunder and the thunder arrester.
- (iii) Teaching how we receive sound from the radio which is relayed from the Radio Station.
- (iv) Preparing hot water with the help of solar heat or energy.
- (v) Giving knowledge about how to produce artificial rain.
- (vi) Teaching how to get electricity from water and steam.
- (vii) Giving basic knowledge about how to operate the machines like washing machine, grinding machine, electric cookers etc.
- (viii) Giving knowledge about how sound is produced from various sound instruments.



**(6) Chemistry**

- (i) Preparation of soap and washing soda.
- (ii) Explaining the uses of Dettol and Phenyl for cleanliness.
- (iii) Preparation of tincture and simple ointments for wounds.
- (iv) Preparation of Dyes.
- (v) Explaining the preparation of Bleaching powder.
- (vi) Explaining the equipping technique and use of gobar plant in the houses making use of animal waste.
- (vii) Explaining the uses and preparation of ammonium nitrate.
- (viii) Explaining the fixation of Nitrogen.
- (ix) Explaining the uses of insecticides.
- (x) Demonstrating the method of purifying water.

**(7) Biology**

- (i) Helping the farmers to get rid of insect pests.
- (ii) Learning methods of vegetative propagation.
- (iii) Introducing modern techniques of incubation in poultry.
- (iv) Practising the way of getting uniform fruiting and blossoming through simple techniques using chemicals (Hormones).
- (v) Leathering of economically important animals.
- (vi) Making them aware of economic Zoology.
- (vii) Provide them the knowledge of crop rotation.
- (viii) Helping them to know about the various sources of Nitrogen manure in the form of Nitrogen yielding plants (Legumes) and easily available cultures to increase the yield.
- (ix) Making them aware of contamination.

**(8) Home Science**

- (i) Raising kitchen garden.
- (ii) Helping the rural people to have poultry units and bee-keeping.
- (iii) Organising rural balwari.
- (iv) Low-cost nutritious food-demonstration.
- (v) Improving arts and crafts.
- (vi) Make use of compost pits.
- (vii) Pest control measures.
- (viii) Nutrition education through various games.

**8.** Fifteen per cent of the working time is to be spent for socially useful productive work. It amounts to about 150 hours a

year. The 150 hours can be distributed throughout the year according to the convenience of schools. Sometimes, if it is impossible to give them every week, a stretch of several hours could be given during the year, for a camp. But continuity should be assured in the work. Many adjustments have to be made in the school time-table to give the students and teachers free time to go to the workspot. The timings suitable for the students must also fit in with the timings of the people in the programme area. After the two year's programme, even when a particular batch of students completes its courses and leaves, the school should plan for follow-up the programmes in the areas, by subsequent batches of students.

9. The programme calls for co-ordination at various levels.

A. *State*

At the state level, the Director of School Education in collaboration with the SCERT or SIE can be in charge of co-ordinating the socially useful productive work scheme in the various schools. The SCERT or SIE may be requested to be in charge of conducting orientation for the Heads of Institutions of the various schools, area-wise and also in monitoring and evaluating the total programme. A state level co-ordinator can be appointed to serve as liaison officer.

B. *District*

At the district level, the District Education Officers with some additional assistance will be co-ordinating the programme. They will support the Heads of the institutions in carrying out the programmes successfully. The teachers-in-charge of the socially useful productive work programme should be given orientation training areawise, for which the District Education Officers would be responsible.

C. *Schools*

At the school level, the Heads of the Institutions should nominate a senior lecturer to be in charge and co-ordinate the entire programme for the school and guide the teacher in charge. All the teachers in the

## *Compulsory Subjects*

school would be guiding the students of their own class in all the aspects of the programme—planning execution and evaluation. The Heads of the institution should scrutinize the records and registers maintained by the students, teachers and teacher-in-charge (co-ordinator) of the programme. The work co-ordinator at the School level should be counted in the work-load of the teacher.

## **ASSESSMENT**

*(Classes XI and XII)*

Evaluation is an important aspect of planning and execution of the Socially Useful Productive Work and Community Service Programme in Schools. From the beginning of the programme each step needs evaluation. An illustrative guide to the areas of assessment and weightage to be given is contained in the following paragraphs.

### **1. Selection of Socially Useful Productive Work and Community Service**

Suggested lists of the Crafts/Services have been given on pages 184 to 188 respectively in the syllabuses booklet.

Candidates will be required to select one craft and one service per year of preparation for the examination, i.e. Classes XI and XII

### **2. Internal Assessment**

The Internal Assessment will consist of assessments in (a) Socially Useful Productive Work and (b) Community Service. The work undertaken by the candidates during the two-year preparation period in each will be assessed and marked out of 50.

### **3. Socially Useful Productive Work**

(i) This will be taken to mean work practice in a craft. In contrast to community service it implies the making of articles of social use or the practice of a skill.

(ii) The areas of assessment of Socially Useful Productive work may be classified as follows :

	<i>Marks</i>
(1) Preparation	5
(2) Organisation	10
(3) Skills	20
(4) Research	10
(5) Interest	5

## ***Compulsory Subjects***

(iii) ***Preparation*** : It is important to select a craft which is socially useful and within the candidates' capabilities. It may be necessary to visit localities where certain crafts are practised and note details of the processes or methods involved.

(iv) ***Organisation*** : The candidates should be able to explain in writing, the tools, materials and processes required as well as draw up a timetable/programme of work.

(v) ***Skills*** : The manipulative skills of the candidates should be assessed regularly and from the finished product(s) and should include the candidates' abilities to follow the processes or methods of the craft.

(vi) ***Research*** : This is the candidates' ability to analyse a process or method and suggest/implement improvements as also improvise wherever necessary.

(vii) ***Interest*** : This is an assessment of the candidates' industriousness, constancy and conscientiousness with regard to the work undertaken. The candidates should be able to adhere to the timetable/programme of work drawn up by them.

(viii) ***Record card*** : This should be kept for each candidate and the assessment of Socially Useful Productive Work entered in it. A specimen of the record card is given on the next page for guidance.

**NAME OF THE SCHOOL**

**Internal Assessment Card for Socially Useful Productive Work**

Name of candidate : .....

Craft/Skill : .....

**ASSESSMENT RECORD**

Date of Assessment	Areas of Assessment									
	Preparation		Organisation		Skills		Research		Interest	
	Grade	Points	Grade	Points	Grade	Points	Grade	Points	Grade	Points

**INTERPRETATION OF GRADES**

<i>Grade</i>	<i>Standard</i>
A	Very Good
B	Good
C	Satisfactory
D	Fair
E	Poor

**4. Community Service :**

(i) This will be taken to mean work done in the home, school and outside which is beneficial to the community.

(ii) The areas of assessment for community service may be as under :

	<i>Marks</i>
(1) Preparation	5
(2) Organisation	10
(3) Skills	20
(4) Resourcefulness	10
(5) Interest	5

## **Compulsory Subjects**

(iii) **Preparation** : It is **important to select a service which will be beneficial to the community. It may be necessary to form teams or squads and to select a leader.**

(iv) **Organisatian** is the knowledge of the tools, materials and methods/processes by which the work can be done, and the ability to draw up a timetable or programme of work.

(v) **Skills** are the manipulative skills of doing the work. The quality of the candidates' work should be assessed.

(vi) **Resourcefulness** is the ability to complete the work inspite of problems and difficulties and to improvise wherever necessary.

(vii) **Interest** is the assessment of the candidates' constancy, industriousness and conscientiousness in doing the work and their abilities to adhere to the timetable or programme drawn up by them.

(viii) A record card on the lines suggested for **Socially Useful Productive Work** (see page 195) should be kept.

(ix) **A practical scheme** for day schools is given below :

(a) In the case of day schools, parents should be involved in making their children aware of their responsibilities in the home and to persons in the area in which they live. They should be encouraged to render service in the home and to their neighbours. Such service may take the form of helping parents in cleaning the house, making the beds, assisting in the kitchen, cleaning backyard, helping in the garden, visiting the sick, teaching a child or children in the neighbourhood, and so on.

Experiments should be tried in every school in which there are day scholars. Parents should be asked to give each child a job of work to do which will last between 20 minutes to half-an-hour *each day*.

(b) A diary should be kept for each child in which the parents enter this every day :

- (i) Nature of work :
- (ii) Time allotted ;
- (iii) Remark of the parent;
- (iv) Signature of the parent.

Thus, it will be possible for the school to ensure that children do at least three to three-and-half hours of **Socially Useful Productive Work, per week.**

(c) The number of hours, as far as the *Social Service* is concerned, in the case of day scholars, will then be within the home and the neighbourhood and may rightly be termed "Homework".

The remarks to be entered by the parent should be specified, so that may be converted into grades.

(d) A suggested five points "remarks" scale is given below :

- A—Very good
- B—Good
- C—Satisfactory
- D—Fair
- E—Poor

(e) The class teacher should be required to enter the "grades" in a special register against each child.

(f) The Council will provide "mark sheets" and instructions to Heads of Schools to submit the SUPW & CS results in terms of grades A, B, C, D and E to the Council.





**INDIAN SCHOOL CERTIFICATE (YEAR-12) EXAMINATION  
MARCH 1991**

**LIST OF PRESCRIBED TEXTBOOKS  
ENGLISH (Compulsory)**

**Paper 1. Language**

Recommended for background reading,

“*Twelve English Essays*” Ed., Muriel Wasi Pub. Frank Brothers  
and Co.

**Paper 2. Prescribed Texts**

Candidates will be required to answer five questions as follows :

One textual question (compulsory) on the Shakespeare play  
together with four other questions on at least three texts which may  
include the Shakespeare play.

Shakespeare : *Macbeth*

Lawson : *Pygmalion*

*Twelve Modern Short Stories* (OUP)

V. Golding : *The Lord of the Flies* (OUP)

*Auses' Delight* : (Ed. S.D.S.N.A. Rizvi) (Pitambar Publishing  
Co.)

**LITERATURE IN ENGLISH (Optional)**

**Paper 1 (Any three of the following)**

Prescribed Books :

1. Dickens : *Great Expectations*
2. Joseph Conrad : *The Secret Agent*
3. Anita Desai : *Fire on the Mountain* (Allied Publishers)
4. Oscar Wilde : *The Importance of being Earnest* (OUP)
5. *Symphony* (A selection of poems) Allied Publishers)

The following poets to be studied :

R. Tagore, A. Ghose, H. Chattopadhyaya, K. Das, W. Wordsworth, G. Byron, P.B. Shelley, E.B. Browning, E. Lear, E.G. Rosetti, J.C. Swinburne, F. Thompson, R. Kilping, W. de la Mare, W. Owen, J. Brooke, W.H. Auden, R.W. Emerson, R. Frost, A.D. Hope.

## Prescribed Books

### Paper 2 (Any three of the following)

#### Prescribed Text books

1. G. Eliot : *The Mill on the Floss*
2. G. Greene : *Brighton Rock*
3. Humayun Kabir : *Men and Rivers* (Orient Longman)
4. Auden and Isherwood : *The Ascent of F6 and on the Frontier* (Available from OUP)
5. *Symphony* (A selection of poems) (Allied Publishers)

The following poets to be studied :

S. Naidu, N. Ezequiel, A.K. Ramanujan, A. Kolatkar, T.S. Coleridge, J. Keats, A. Tennyson, R. Browning, M. Arnold, T. Hardy, R.L. Stevenson, A.E. Housman, W.B. Yeats, W.H. Davis, R. Bridges, W.F. Henley, T.S. Eliot, S. Spender, W. Whitman, J. Wright.

## INDIAN LANGUAGES : Paper 2

### 1. ASSAMESE

(Any three of the following) :

1. *Pragviswavidyalay Kavita Chayan* (University of Gauhati).

The following to be studied :

- (i) Dadhi-mathan
- (ii) Kankhowa
- (iii) Dhanbar Aru Ratani
- (iv) Tejjimala
- (v) Padum
- (vi) Keteki
- (vii) Ei Bate Nahiba Dunai
- (viii) Urmila
- (ix) Sesh Arghya
- (x) Devadasi

2. *Phul* by Dandinath Kalita
3. *Gaonburha* by Padamanath Gohainbarua
4. *Anandaram Barua* by Dr. Surya Kumar Bhuyan

Note : *Essay-type* questions will be set on all books.

## 2. BENGALI

(Any three of the following) :

1. *Kavyavichitra* 2 (Ed. Ghose and Devi, OUP)

Only the following selection is to be studied :

- (i) Ramer Kaikeyi Sambodhan—Krittibas
- (ii) Draupadi—Judhisthir Sambad—Kashiram Das
- (iii) Annadar Bhabananda Bhabane Jatra—Mukundaram
- (iv) Swadhinata—Rangalal Bandyopadhyaya
- (v) Bangabhumir Prati—Michael M. Dutt
- (vi) Mohanlaler Khed—Nabinchandra Sen
- (vii) Shobujer Abhijan—Rabindranath Tagore
- (viii) Jiban Bhiksha—Karunanidhan Bandyopadhyaya
- (ix) Aboltabol—Sukumar Ray
- (x) Banalata Sen—Jibananananda Das
- (xi) Paraparer Kamana—Golam Mustafa
- (xii) Jiban Bandana—Kaji Najrul Islam
- (xiii) Asia—Nirendranath Chakravarti
- (xiv) Agami—Sukanta Bhattacharya

2. *Gadyavichitre* (OUP)

Only the following selection is to be studied :

- (i) Swapnadarshan—Vidyabishayak—Aksoy R. Dutta
- (ii) Aihikata—Bhudeb Mukhopadhyaya
- (iii) Alaler Ghare Dulal—Tek Chand Thakur
- (iv) Palamau—Sanjib Chandra Chattopadhyaya
- (v) Babu—Bankim Chandra Chattopadhyaya
- (vi) Shabek Manushyatva 0 Haler Shine Kara—Haraprasad Shastri
- (vii) Bankim Chandra Chattopadhyaya—Shibnath Shastri
- (viii) Maha—ummagga Jataka—Ishan Chandra Ghose
- (ix) Sekaler Sukh-Duhkha—Aksay Kumar Maitreya
- (x) Sabhatar Sankat—Rabindranath Tagore
- (xi) Bartaman Bharat—Swami Vivekananda
- (xii) Phuler Mulya—Prabhat Kumar Mukhopadhyaya
- (xiii) Bangla Sahitya 0 Chhatra Samaj—Md. Shahidulla
- (xiv) Punya Sariti—Seeta Devi

3. Sarat Chander : *Nishkriti*

### *Prescribed Books*

4. Rabindra Nath Tagore : *Rajshri*
5. D.L. Roy : *Chandra Gupta*

**Note** : Essay-type questions will be set on all books.

### **3. DZONGKHA**

1. *Yitan Zadrel Thingig* (Prose)
2. *Chushingi Ronchod* (Proverbs)
3. *Biography of Khando Dowa Zangmo*

**Note** : *Essay-type* questions will be set on all books.

### **4. GUJARATI**

(Any *three* of the following) :

1. *Gujarati Gadaya-Padya Sangraha*

The following to be studied :

12 poems from No. 7 to 18 (Ek Shaherano Ray to Apna Ghadvara Bandhan Apne)

2. *Sapna Bhara* by Umashankar Joshi
3. *Divya Chakshu* by Ramnlal Desai
4. *Dhumketu Varta*—Saurabha Part II by Dhumketu

**Note** : *Essay-type* questions will be set on all books.

### **5. HINDI**

(Any *three* of the following) :

1. *Abhinav Bharati* (OUP)

Only the following selections :

- (i) Vayu Dooti
- (ii) Ek Boond
- (iii) Maa Keh Ek Kahani
- (iv) Panchvati Main Lakshman
- (v) Jharna
- (vi) Chitrakoot Mein Shri Ram
- (vii) Le Chal Wahan Bhulawa Dekar
- (viii) Bhikhari
- (ix) Dolewalo
- (x) Mera Naya Bachpan
- (xi) Murjhaya Phool
- (xii) Babu Ke Chale Jaane Par

- (xiii) Geet—Ageet  
 (xiv) Gautami  
 (xv) Basanti Hawa  
 (xvi) Mera Ghar Ho Nadi Kinare
2. *Mahaprayana* by Dr. R.M. Bhatnagar  
(Pitambar Publishing Co.)
  3. *Adarsh Kahani Sangrah* (Pitambar Publishing Co. Pvt. Ltd.)
  4. *Jwala Mukhi Ka Phool* : Sushil Kumar (Inter University Press).
  5. *Karmabhumi* (abridged) by Munshi Premchand.
- Note** : *Essay-type* questions will be set on all books.

## 6. KANNADA

(Any three of the following) :

1. *Pakshi Kashi* by G.K.V. Puttappa (Udaya Ravi Prakashan, Mysore-570002).
2. *Subhana* by Masti Venkatesh Aiyangar.
3. *Shoka Chakra* by Sree Ranga.
4. *Bharatada Manasaputriyaru* by Smt. Shantadevi Malawad ; (Samaja Pustakalya, Dharwad).

**Note** : *Essay-type* questions will be set on all books.

## 7. KHASI

(Any three of the following) :

1. *Ki Poetry Khasi* by V.G. Bareh  
 The following to be studied :
  - (i) Ka Lunti Umian
  - (ii) Ka Jingud Ka Sohlyngngem
  - (iii) Ka Pyrem
  - (iv) U Klew bad Ka Sugi
  - (v) Ka Synrai hala ka Ri
  - (vi) Ka Wah Umkhrah
  - (vii) U Tngam had ka Wahduk
  - (viii) Ka Weiking
  - (ix) Ka Sngi ba la noh
  - (x) Ka Duitara jong nga
  - (xi) Ka saia Nongum

## Prescribed Books

2. *U Don Putit* by D.S. Khonglah
3. *Ka Tiew Larum* by S.J. Duncan
4. *Mihngi—Spengi* by H. Elias (Lynnong 2, 7, 12, 15, 20, 23, 25, 27, 29 and 30 only)

Note : *Essay-type* questions will be set on all books.

### 8. LUSHAI

1. *Thi-Hna*, An anthology of Mizo Prose and Poetry, North-Eastern Hill University Publications.
2. *Thiahrang*, by Lalzuithanga, Published by Laldinga and printed at Bethel Press, Khatla, Aizawal, Mizoram.
3. *Hawilopari*, by Bikliana. North-Eastern Hill University Publications.

### 9. MALAYALAM

(Any three of the following) :

1. *Chandalo Bikshuki* by Kumaran Asan (Current Books, Kottayam).
2. *Sarada* by O. Chandu Menon (National Book Stall, Kottayam).
3. *Pathu Kathakal* by Karoor (National Book Stall, Kottayam).
4. *Seetha Muthal Sathyvathi Vare* by Lalithambika (National Book Stall, Kottayam).

Note : *Essay-type* questions will be set on all books.

### 10. MANIPURI

1. *Manipuri Sheireing* (published by Manipur Sahitya Parishad, available at the Parishad office).
2. *Manipuri Wareng* (published by the Cultural Forum, Manipuri —available in the Public Book Store, Paona Bazar, Imphal).

### 11. MARATHI

(Any three of the following) :

1. *Patram Pushpam* (Edited by Prof. K. B. Nikumb and Prof. G.M. Kulkarni, Published by Vidarbha Marathawada Book Company ; 1334, Shukrawar Peth, Poona-411002).

(Only the following section) :

- (i) Sfurtee
- (ii) Pakhar Yeshil Ka Partun

- (iii) Gopha
  - (iv) Udasinata
  - (v) Maga visar hava tar Ha Khasana ge
  - (vi) Sajavu Kartik Masa
  - (vii) Ala Ashadna Sharvan
  - (viii) Chokha Melyachi Samadhi
  - (ix) Halu Halu Yei Rata
  - (x) Nichinta
  - (xi) Aaiche Mana
  - (xii) Kolambasache Garva Geeta
2. *Akhera che Banda* (Sankhipta by N. S. Phadake, Published by Kontinental Prakashan, Appa Balavant Chouka, Poona-411002).
  3. *Kanchanachi Niranjane* Edited by Anuradha Potdar (Published by Vidarbha Marathawada Book Company, 1334, Shukrawar Peth, Poona-411002).
  4. *Tu Jhe Ahe Tuj Pashi* by Deshpande (Published by Parachure Prakashan Mandir, Girgaon, Bombay-400001).

Note : *Essay-type* questions will be set on all books.

## H2. NEPALI

(Any three of the following) :

1. *Shajha Kavita*, Shajha Prakashan  
(Only the following selection) :
  - (i) Atmako Sudhi by Basanta Sharma
  - (ii) Bhaktamala by Bhanubhakta Acharya
  - (iii) Kehi Phutkar Kavita by Bhanubhakta Acharya
  - (iv) Panchak Prapancha by Motiram Bhatta
  - (v) Satya Sandesh by Lekhnath Paundyal
  - (vi) Kavi Bhanubhaktapradi by Dharnidhar Koirala
  - (vii) Nimto by Balakrishna Sama
  - (viii) Gainey by Laksmiprasad Devkota
  - (ix) Kavi Devkotalai by Sidhicharan Shrestha
  - (x) Chitra by Okiyama Guyen
  - (xi) Mela by Birendra Subba
  - (xii) Nachinney Bhayachau by Agamsingh Giri
  - (xiii) Yee Daran Karan Ghantaghar by Bhupi Sherchen



## Prescribed Books

- (xiv) Prabat Bairagi Kaila
2. *Shajha Katha* : Shajha Prakashan (only the following selection) :
- (i) Abhagai by Guruprasad Mainali
  - (ii) Biteka Kuru by Rupnarayan Singha
  - (iii) Chhaya by Bhimnidhi Tiwari
  - (iv) Jyanmara by Shivakumar Rai
  - (v) Prasna by Bhaichandra Pradhan
  - (vi) Ardhamudit Nayan by Shankar Lamichanney
  - (vii) Paatan by Bhijab Malla
  - (viii) Jayamalla Aphu Matra Indrabahadur Rai
  - (ix) Lahuri Bhainsi by Ramesh Bikal
  - (x) Aruka Phul by Ishwar Bhallabh
3. *Dak Bangla* by Shivakumar Rai Nepali Sahitya Sanchayika, Darjeeling
4. *Academy Nibandhawali* by Srimati Lahi Devi Sundas  
Nepali Academy : (N.B.U.) (only the following selection) :
- (i) Bhasa
  - (ii) Nepali Vyakranko Chotto Ithyas
  - (iii) Vani-bisawney-thego
  - (iv) Acharya Bhanubhakta
  - (v) Loksahityama Sabaiko Sthan
  - (vi) Bharatma Nepali Patra-Patrikako Athaisau Barsa
  - (vii) Natyakar Balkrishna Sam—Ek Bibechanna
  - (viii) Kalara Jiwan
  - (ix) Birsiyeka Sanskriti
  - (x) Anjana Devi
  - (xi) Hasya
  - (xii) Ghar

**Note** : *Essay-type* questions will be set on all books.

## 13. ORIYA

(Any *three* of the following) :

1. *Adhunik Saral Kakita* by Professor Shri Sridhar Dass  
(Published by Shri Aviram Mohapatra, Grantha Mandir,  
Cuttack-753002, Orissa)

2. *Jibani Bartika* by Prof. Sri Sridhar Dass (Published by Shri Aviram Mohapatra, Grantha Mandira, Cuttack-753002, Orissa). The first five biographies to be studied only.
3. *Ebe Madhya Banchichhi* Godabarish Mohapatra. (Published by Sri Debabrata Kar, Orissa, Book Emporium, Cuttack-753002, Orissa)
4. *Adhunika Ekanikika Sangrah* by Prof. Sri Gopal Chandra Mishra and Shri Sribaram Mohapatra, (Published by Shri Aviram Mohapatra, Grantha Mandir, Cuttack-753009, Orissa). The first five Act Plays to be studied only.

Note : *Essay-type* questions will be set on all books.

#### 14. PUNJABI

(Any three of the following) :

1. *Adhunik Punjabi Kavita* (Published by Punjabi University, Patiala)
2. *Pavitar Papi* by Nanak Singh
3. *Katha Punjabi* (Published by National Book Trust, Delhi)
4. *Arsi* by Teja Singh

Note : *Essay-type* questions will be set on all books.

#### 15. TAMIL

(Any three of the following) :

1. *Selection in Poetry* (Published by Tamilnadu Government Text Book Publishing Society for Higher Secondary Second Year 1980 Examination Part I Tamil 1979 Edition)
2. *Tamil Thunai Pada Nool* (Tamil stories for non-detailed study 1979 edition, Published by the Tamilnadu Text Book Committee, Madras-600006 and prescribed for the Tamil Nadu Board's Examination for Class XII, 1980)
3. *Sinekithi* by Akilan (Published by Vaskar Vattan Puthagappanippirvu, 14, Thanigachalan Chetti Road, Madras-600017).
4. *Yon Canda Elangi* by Dr. M. Varadarajan (Published by Parinilayam, 59, Broadway, Madras-600001)

Note : *Essay-type* questions will be set on all books.

## Prescribed Books

### 16. TELUGU

(Any three of the following) :

1. *Kavya Manjari* (Poetry) Published by Sri Ram Book Depoot, Secunderabad.
2. *Andhra Prabandhakathalu*
3. *Raja Raju*
4. *Ekanka Sangraham* : Telugu translation by A. Hanumatth Sastri. (Sahitya Academy, Madras).

Note : *Essay-type* questions will be set on all books.

### 17. URDU

(Any three of the following) :

1. *Answer-E Adab* by Faisuddin Siddiqui & Majahid Hussaain Hussaini (Published by Maktaba Jamia Ltd., New Delhi).

Only the following selection :

(i) *Ghazaliyat* Ghalib and Iqbal

(ii) *Mathnavi* Shauk Lakhnavi

(iii) *Manzoomat*

(a) *Banjara* : Nazeer Akbar Abadi

(b) *Yaad* : Faiz Ahmed Faiz

(c) *Kaun Dushman Hai* : Ali Sardar Jafri

(d) *Faraar* : Sahir Ludhianvi

(iv) *Rubaiyat* : Firaq Gorakhpuri

2. *Nazeer Ahmad ki Kahani Kuchh Unki Kuchh Meri Zabaani* | by Mirza Farhatullha Beg (Published by Educational Book House, Aligarh)
3. *Anjaam* by Mohd. Mujeeb (Published by Maktaba Jamia Lttd., New Delhi)
4. *Sharif Zadah* by Mirza Mohd. Hadi Hassan Ruswa (Published by Maktaba Jamia Ltd., New Delhi)

Note : *Essay-type* questions will be set on all books.

## CLASSICAL LANGUAGES

### 1. SANSKRIT

(i) *Chandrapid Katha* by Pandit V. Anantacharya Published by :  
Ram Narayana Lal Beni  
Madhava  
Publisher and Book-Seller,  
Allahabad-211002

(ii) *Raghuvama* of Kalidasa, Canto I  
Text with English Translation and Notes by M.R. Kale  
Published by Moti Lal Banarsi Das,  
Delhi, Patna & Varanasi.

### 2. PERSIAN (Classical)

*Farsi Va Dastoor*

Available from Anjuman Tarrqie Urdu

### 3. ARABIC

(i) Prose : *Atyabul Mantakbaat* (pp. 3-95)  
Published by Anwar Ahmedi Press, Allahabad.

(ii) Poetry : *Atyabul Mantakbaat*  
Published by Anwar Ahmedi Press, Allahabad.

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