EXAMINATION NOTICE NO.07/2017-IFoS                  DATED 22.02.2017
(LAST DATE FOR SUBMISSION OF APPLICATIONS : 17.03.2017)
INDIAN FOREST SERVICE EXAMINATION, 2017
(Commission's website - www.upsc.gov.in)

IMPORTANT

• CANDIDATES APPLYING FOR INDIAN FOREST SERVICE EXAMINATION SHOULD NOTE THAT THEY ARE REQUIRED TO APPEAR IN THE CIVIL SERVICES (PRELIMINARY) EXAMINATION AND QUALIFY THE SAME FOR GOING TO THE SECOND STAGE OF INDIAN FOREST SERVICE (MAIN) EXAMINATION (WRITTEN AND INTERVIEW).

• CANDIDATES DESIRIOUS OF APPLYING FOR INDIAN FOREST SERVICE EXAMINATION AS WELL AS FOR THE CIVIL SERVICES EXAMINATION CAN APPLY THROUGH A COMMON ONLINE APPLICATION FORM SUBJECT TO MEETING THE REQUISITE ELIGIBILITY CRITERIA BY THEM.

1. CANDIDATES TO ENSURE THEIR ELIGIBILITY FOR THE EXAMINATION:
Candidates applying for the examination should ensure that they fulfill all eligibility conditions for admission to the Examination. Their admission at all the stages of the examination will be purely provisional subject to satisfying the prescribed eligibility conditions. Mere issue of Admission Certificate to the candidate will not imply that his/her candidature has been finally cleared by the Commission. Verification of eligibility conditions with reference to original documents is taken up only after the candidate has qualified for Interview/Personality Test.

2. HOW TO APPLY:
Candidates are required to apply online only by using the website www.upsconline.nic.in Brief instructions for filling up the online Application Form have been given in Appendix-II. Detailed instructions are available on the above mentioned website.

3. LAST DATE OF SUBMISSION OF APPLICATIONS:
The Online Applications can be filled up to 17th March, 2017 till 18.00 Hours.

4. The eligible candidates shall be issued an e-Admit Card three weeks before the commencement of the examination. The e-Admit Card will be made available in the UPSC website [www.upsc.gov.in] for downloading by candidates. No Admission Certificate will be sent by post. All the applicants are required to provide valid active E-Mail I.D. while filling up Online Application Form as the Commission may use electronic mode for contacting them at different stages of examination process.

5. PENALTY FOR WRONG ANSWERS:
Candidates should note that there will be penalty (Negative Marking) for wrong answers marked by a candidate in the Objective Type Question Papers.

6. For both writing and marking answers in the OMR sheet [Answer Sheet], candidates must use black ball pen only. Pens with any other colours are prohibited. Do not use Pencil or Ink pen. Candidates are further advised to read carefully the "Special Instructions" contained in Appendix-III of the Notice.

7. FACILITATION COUNTER FOR GUIDANCE OF CANDIDATES:
In case of any guidance/information/clarification regarding their applications, candidature etc. candidates can contact UPSC's Facilitation Counter near 'C' Gate of its campus in person or over Telephone No. 011-23385271/011-23381125/011-23098543 on working days between 10.00 hrs and 17.00 hrs.

8. Mobile Phones Banned:
(a) Mobile phones, bluetooth or any other communication devices are not allowed inside the premises where the examination is being conducted. Any infringement of these instructions shall entail disciplinary action including ban from future examinations.

(b) Candidates are advised in their own interest not to bring any of the banned items including mobile phones/bluetooth or any valuable/costly items to the venue of the examination, as arrangement for safe-keeping cannot be assured. Commission will not be responsible for any loss in this regard.

CANDIDATES ARE REQUIRED TO APPLY ONLINE ONLY. NO OTHER MODE IS ALLOWED FOR SUBMISSION OF APPLICATION.
F.No.13/4/2016-El(B): The Union Public Service Commission will hold a Screening Test for selection to Indian Forest Service (Main) Examination, 2017 through Civil Services (Preliminary) Examination, 2017 which will be held on 18th June, 2017, in accordance with the Rules published by the Ministry of Environment, Forests and Climate Change in the Gazette of India dated the 22nd February, 2017.

(A) The Preliminary Examination will be held at the following Centers:

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The centres and the date of holding the examination as mentioned above are liable to be changed at the discretion of the Commission. Applicants should note that there will be a ceiling on the number of candidates allotted to each of the Centres, except Chennai, Dispur, Kolkata and Nagpur. Allotment of Centres will be on the “first-apply-first allot” basis, and once the capacity of a particular Centre is attained, the same will be frozen. Applicants, who cannot get a Centre of their choice due to ceiling, will be required to choose a Centre from the remaining ones. Applicants are, thus, advised that they may apply early so that they could get a Centre of their choice.

NB: Notwithstanding the aforesaid provision, Commission reserve the right to change the Centres at their discretion if the situation demands.

All the Examination Centres for CS(P) 2017 Examination will cater to examination for Low Vision Candidates in their respective centres. Candidates admitted to the examination will be informed of the time table and place or places of examination.

The candidates should note that no request for change of centre will be entertained.

(B) PLAN OF EXAMINATION

The Indian Forest Service Examination will consist of two successive stages (vide Appendix I Section-I below).

(i) Civil Services (Preliminary) Examination (Objective type) for the selection of candidates for the Indian Forest Service (Main) Examination; and

(ii) Indian Forest Service (Main) Examination (Written and Interview) for the selection of candidates for the Indian Forest Service.

Applications are now invited for the Preliminary Examination only. Candidates who will be declared by the Commission to have qualified for admission to the Indian Forest Service (Main) Examination will have to apply again, in the Online Detailed Application Form which would be made available on the Website of the Commission after declaration of Results of Preliminary Examination. The Main Examination is likely to be held in December, 2017. The Main Examination will be held on the following Centres:

Bhopal, Chennai, Delhi, Dispur (Guwahati), Hyderabad, Kolkata, Lucknow, Nagpur, Port Blair and Shimla.

2. The number of vacancies to be filled on the results of the examination is expected to be approximately 110. The number of vacancies is liable to alteration. Reservation will be made for candidates belonging
to Scheduled Castes, Scheduled Tribes, Other Backward Classes and Physically Handicapped Categories in respect of vacancies as may be fixed by the Government.

**Note:** As per the information received from the Ministry of Environment, Forests and Climate Change, 1 vacancy has been kept reserved for Low Vision category and 2 vacancies have been kept reserved Hearing Impaired category. However the vacancies indicated are liable to further alteration.

A candidate will be eligible to get the benefit of community reservation only in case the particular caste to which the candidates belong is included in the list of reserved communities issued by the Central Government. If a candidate indicates in his/her Application Form for Indian Forest Service Examination that he/she belongs to General Category but subsequently writes to the Commission to change his/her category, to a reserved one, such request shall not be entertained by the Commission. Similar principle will be followed for physically disabled category also. While the above principle will be followed in general, there may be a few cases where there was a little gap (say 2-3 months) between the issuance of a Government Notification enlisting a particular community in the list of any of the reserved communities and the date of submission of the application by the candidate. In such cases the request of change of community from General to Reserved may be considered by the Commission on merit. In case of a candidate unfortunately becoming physically disabled during the course of the examination process, the candidate should produce valid documents showing him/her acquiring a disability to the extent of 40% or more as defined under the PwD Act, 1995 to enable him to get the benefits of PH reservation provided he/she otherwise remains eligible for Indian Forest Service as per Rule 19 of Indian Forest Service Examination.

Candidates seeking reservation/relaxation benefits available for SC/ST/OBC/PH/ Ex-servicemen must ensure that they are entitled to such reservation/relaxation as per eligibility prescribed in the Rules/Notice. They should also be in possession of all the requisite certificates in the prescribed format in support of their claim as stipulated in the Rules/Notice for such benefits, and these certificates should be dated earlier than the due date (closing date) of the application for the Civil Services (Preliminary) Examination.

3. **ELIGIBILITY CONDITIONS:**

**(i) NATIONALITY:**

A candidate must be either:

(a) A citizen of India, or
(b) a subject of Nepal, or
(c) a subject of Bhutan, or
(d) a Tibetan refugee who came over to India before 1st January, 1962 with the intention of permanently settling in India, or
(e) a person of Indian origin who has migrated from Pakistan, Burma, Sri Lanka, East African countries of Kenya, Uganda, the United Republic of Tanzania, Zambia, Malawi, Zaire, Ethiopia and Vietnam with the intention of permanently settling in India.

Provided that a candidate belonging to categories (b), (c), (d) and (e) shall be a person in whose favour a certificate of eligibility has been issued by the Government of India.

A candidate in whose case a certificate of eligibility is necessary, may be admitted to the examination but the offer of appointment may be given only after the necessary eligibility certificate has been issued to him/her by the Government of India.

**(ii) AGE LIMITS:**

(a) A candidate must have attained the age of 21 years and must not have attained the age of 32 years on **1st August, 2017**, i.e. he must have been born not earlier than **2nd August, 1985** and not later than **1st August, 1996**.

(b) The upper age limit prescribed above will be relaxable:

(i) upto a maximum of five years if a candidate belongs to a Scheduled Caste or a Scheduled Tribe.

(ii) upto a maximum of three years in the case of candidates belonging to Other Backward Classes who are eligible to avail of reservation applicable to such candidates.

(iii) upto a maximum of five years if a candidate had ordinarily been domiciled in the State of Jammu & Kashmir during the period from the 1st January, 1980 to the 31st day of December, 1989.

(iv) upto a maximum of three years in the case of Defence Services personnel disabled in operations during hostilities with any foreign country or in a disturbed area and released as a consequence thereof:
(v) upto a maximum of five years in the case of ex-servicemen including Commissioned Officers and ECOs/SSCOs who have rendered at least five years Military Service as on 1st August, 2017 and have been released (i) on completion of assignment (including those whose assignment is due to be completed within one year from 1st August, 2017) otherwise than by way of dismissal or discharge on account of misconduct or inefficiency, or (ii) on account of physical disability attributable to Military Service, or (iii) on invalidment.

(vi) upto a maximum of five years in the case of ECOs/SSCOs who have completed an initial period of assignment of five years of Military Service as on 1st August, 2017 and whose assignment has been extended beyond five years and in whose case the Ministry of Defence issues a certificate that they can apply for civil employment and that they will be released on three months’ notice on selection from the date of receipt of offer of appointment.

(vii) upto a maximum of 10 years in the case of Low Vision and Hearing Impaired persons.

NOTE I - Candidates belonging to the Scheduled Castes, the Scheduled Tribes and the Other Backward Classes who are also covered under any other clauses of para 3(ii) (b) above, viz. those coming under the category of Ex-servicemen, persons domiciled in the State of J & K, Low Vision and Hearing Impaired person etc. will be eligible for grant of cumulative age-relaxation under both the categories.

NOTE II - The term ex-servicemen will apply to the persons who are defined as ex-servicemen in the Ex-servicemen (Reemployment in Civil Services and Posts) Rules, 1979, as amended from time to time.

NOTE III - The age concession under Para 3(ii)(b)(v) and (vi) will not be admissible to Ex-Servicemen and Commissioned Officers including ECOs/SSCOs, who are released on own request.

NOTE IV - Notwithstanding the provision of age-relaxation under para 3(ii) (b) (vii) above, a physically disabled candidate will be considered to be eligible for appointment only if he/she (after such physical examination as the Government or appointing authority, as the case may be, may prescribe) is found to satisfy the requirements of physical and medical standards for the concerned Services/posts to be allocated to the physically disabled candidates by the Government.

SAVE AS PROVIDED ABOVE THE AGE LIMITS PRESCRIBED CAN IN NO CASE BE RELAXED.

The date of birth accepted by the Commission is that entered in the Matriculation or Secondary School Leaving Certificate or in a certificate recognized by an Indian University as equivalent to Matriculation or in an extract from a Register of Matriculates maintained by a University, which extract must be certified by the proper authority of the University or in the Higher Secondary or an equivalent examination certificate.

These certificates are required to be submitted only at the time of applying for the Indian Forest Service (Main) Examination.

No other document relating to age like horoscopes, affidavits, birth extracts from Municipal Corporation, service records and the like will be accepted.

The expression Matriculation/Secondary Examination Certificate in this part of the instruction includes the alternative certificates mentioned above.

NOTE 1: Candidates should note that only the Date of Birth as recorded in the Matriculation/Secondary Examination Certificate or an equivalent certificate on the date of submission of applications will be accepted by the Commission and no subsequent request for its change will be considered or granted.

NOTE 2: Candidates should also note that once a Date of Birth has been claimed by them and entered in the records of the Commission for the purpose of admission to an Examination, no change will be allowed subsequently (or at any other Examination of the Commission) on any grounds whatsoever.

Note 3: The candidate should exercise due care while entering their date of birth in the Online Application Form. If on verification at any subsequent stage, any variation is found in their date of birth from the one entered in their matriculation or equivalent Examination certificate, disciplinary action will be taken against them by the Commission under the Rules.

(iii) MINIMUM EDUCATIONAL QUALIFICATIONS:

The candidate must hold a Bachelor’s degree with at least one of the subjects namely Animal Husbandry & Veterinary Science, Botany, Chemistry, Geology, Mathematics, Physics, Statistics and Zoology or a Bachelor’s degree in Agriculture, Forestry or in Engineering of any of Universities incorporated by an Act of the Central or State Legislature in India or other educational institutions established by an Act of Parliament or declared to be deemed as a University under Section 3 of the University Grants Commission Act, 1956, or possess an equivalent qualification.

Note 1: Candidates who have appeared at an examination the passing of which would render them educationally qualified for the Commission’s examination but have not been informed of the results as also the candidates who intend to appear at such a qualifying examination will also be eligible for admission to the Preliminary Examination. All candidates who are declared qualified by the Commission for taking the Indian Forest Service (Main) Examination will be required to produce proof of passing the requisite examination with their application for the Main Examination failing which such candidates will not be admitted to the Indian Forest Service Main Examination. The applications for the Main Examination will be called sometime in the month of June/July, 2017 through on-line mode.
NOTE II: In addition, the candidates who possess qualification equivalent to those specified in Rule 7 will be required to produce a certificate from University incorporated by an Act of the Central or State Legislature in India or other educational institutions established by an Act of the Parliament or declared to be deemed as a University under Section 3 of the University Grants Commission Act, 1956 clarifying that the degree is at par with the Bachelor's degree specified in Rule 7 along with their application for the Main Examination failing which such candidate will not be admitted to the Main Examination.

NOTE III: In exceptional cases the Union Public Service Commission may treat a candidate who has not any of the foregoing qualifications as a qualified candidate provided that he/she has passed examination conducted by the other Institutions, the standard of which in the opinion of the Commission justifies his/her admission to the examination.

(iv) NUMBER OF ATTEMPTS:
Every candidate appearing at the Examination, who is otherwise eligible, shall be permitted six attempts at the examination.

Provided that this restriction on the number of attempts will not apply in the case of Scheduled Caste and Scheduled Tribe candidates who are otherwise eligible.

Provided further that the number of attempts permissible to candidates belonging to Other Backward Classes who are otherwise eligible, shall be nine.

Provided further that a physically handicapped will get as many attempts as are available to other non-physically handicapped candidates of his or her community, subject to the condition that a physically handicapped candidate belonging to the General Category, shall be eligible for nine attempts. Necessary action to make corresponding changes in respective Rules/Regulations pertaining to Indian Forest Service is being taken separately. The relaxation will be available to the physically handicapped candidates who are eligible to avail of reservation applicable to such candidates.

NOTE:
(i) An attempt at a Preliminary Examination shall be deemed to be an attempt at the Examination.

(ii) If a candidate actually appears in any one paper in the Preliminary Examination, as a candidate for the Indian Forest Service (Main) Examination, he/she shall be deemed to have made an attempt at the Examination.

(iii) Notwithstanding the disqualification/cancellation of candidature the fact of appearance of the candidate at the examination will count as an attempt.

(V) PHYSICAL STANDARDS:
Candidates must be physically fit according to physical standards for admission to Indian Forest Service Examination, 2017 as per regulations given in Appendix-III of the rules for the Indian Forest Service Examination, 2017 published in Gazette of India dated 22nd February, 2017.

4. FEE
Candidates applying (excepting Female/SC/ST/PH candidates who are exempted from payment of fee) for Civil Services (Preliminary) Examination are required to pay a fee of Rs.100/- (Rupees One Hundred only) either by depositing the money in any Branch of SBI by cash, or by using net banking facility of SBI, State Bank of Bikaner & Jaipur/State Bank of Hyderabad/State Bank of Mysore/State Bank of Patiala/State Bank of Travancore or by using Visa/Master Credit/Debit card.

Applicants who opt for "Pay by Cash" mode should print the system generated Pay-in-slip during part II registration and deposit the fee at the counter of SBI Branch on the next working day only. "Pay by Cash" mode will be deactivated at 23.59 hours of 16.03.2017 i.e. one day before the closing date; however applicants who have generated their Pay-in-Slip before it is deactivated may pay at the counter of SBI Branch during banking hours on the closing date. Such applicants who are unable to pay by cash on the closing date i.e. during banking hours at SBI Branch, for reasons whatsoever, even if holding valid pay-in-slip will have no other offline option but to opt for available online Debit/Credit Card or Internet Banking payment mode on the closing date i.e. till 18.00 hours of 17.03.2017.

For the applicant in whose case payments details have not been received from the bank, they will be treated as fictitious payment cases and a list of all such applicants shall be made available on the Commission's website within two weeks after the last day of submission of Online Application. These applicants shall also be intimated through e-mail to submit copy of proof of their payment to the Commission at the address mentioned in the e-mail. The applicant shall be required to submit the proof within 10 days from the date of such communication either by hand or by speed post to the Commission. In case, no response is received from the applicant, their application shall be summarily rejected and no further correspondence shall be entertained in this regard.

All female candidates and candidates belonging to Scheduled Castes/Scheduled Tribes/ Physically Handicapped categories are not required to pay any fee. No fee exemption is, however, available to OBC candidates and they are required to pay the full prescribed fee. There will be separate examination fee for Indian Forest Service (Main) Examination, for those who will qualify for the same through the Civil Services (Preliminary) Examination, for which appropriate notice will be issued at the time of filling up of on-line application for the second stage.

Physically Disabled Persons are exempted from the payment of fee provided they are otherwise eligible for appointment to the Services/Posts to be filled on the results of this examination on the basis of the standards of medical fitness for these Services/Posts (including any concessions specifically extended to the physically
Candidates are required to apply Online using the link www.upsconline.nic.in of the Commission. Detailed instructions for filling up Online Applications are available on the above mentioned website.

The applicants are advised to submit only single application, however, if due to any unavoidable situation, if he/she submits another/multiple applications, then he/she must ensure that application with the higher RID is complete in all respects like applicants details, examination centre, photograph, signature, fee etc. The applicants who are submitting multiple applications should note that only the applications with higher RID (Registration ID) shall be entertained by the Commission and fee paid against one RID shall not be adjusted against any other RID.

(b) All candidates, whether already in Government Service, or in Government owned industrial undertakings or other similar organizations or in private employment should submit their applications direct to the Commission.

Persons already in Government service, whether in a permanent or temporary capacity or as work charged employees other than casual or daily rated employees or those serving under Public Enterprises are however, required to inform their Head of Office/Department that they have applied for the Examination. Candidates should note that in case a communication is received from their employer by the Commission withholding permission to the candidates applying for/appearing at the examination, their applications will be liable to be rejected/candidature will be liable to be cancelled.

NOTE I: While filling in his/her Application Form, the candidate should carefully decide about his/her choice for the centre and optional subjects for the Indian Forest Service (Main) Examination. More than one application from a candidate giving different centres and/or optional subjects will not be accepted in any case. Even if a candidate sends more than one completed application, the Commission will accept only one application at their discretion and the Commission’s decision in the matter shall be final. If any candidate appears at a centre/optional subjects other than those indicated by the Commission in his/her Admission Certificate, the papers of such a candidate will not be valued and his/her candidature will be liable to cancellation.

NOTE-2: Providing scribe to a Low Vision candidate or allowing him/ her to bring his/ her own scribe, suitable provisions have been made in the online application programme to get the information at the time of the initial online application itself.

NOTE-3: Candidates appearing in CS(P) Examination, 2017 will be required to indicate information such as (a) detail of centres for Civil Services (Main) Examination and Indian Forest Service (Main) Examination (b) Optional subject to be selected for both the examinations, (c) medium of examination for Civil Services (Main) Examination and (d) compulsory Indian language for Civil Services (Main) Examination at the time of the filling up online application itself, incase he/she is applying for both the Civil Services Examination and the Indian Forest Service Examination or else requisite examination specific information, as the case may be.

NOTE 4 : Candidates are not required to submit along with their applications any certificate in support of their claims regarding Age, Educational Qualifications, Scheduled Castes/ Scheduled Tribes/Other Backward Classes and Physically disabled etc. which will be verified at the time of the Main examination only. The candidates applying for the examination should ensure that they fulfill all the eligibility conditions for admission to the Examination. Their admission at all the stages of examination for which they are admitted by the Commission viz. Preliminary Examination, Main (Written) Examination and Interview Test will be purely provisional, subject to their satisfying the prescribed eligibility conditions. If on verification at any
time before or after the Preliminary Examination, Main (written) Examination and Interview Test, it is found that they do not fulfill any of the eligibility conditions; their candidature for the examination will be cancelled by the Commission. If any of their claims is found to be incorrect, they may render themselves liable to disciplinary action by the Commission in terms of Rule 12 of the Rules for the Indian Forest Service Examination, 2017 reproduced below:

A candidate who is or has been declared by the Commission to be guilty of:

(i) Obtaining support for his candidature by the following means, namely :-
   (a) offering illegal gratification to, or
   (b) applying pressure on, or
   (c) blackmailing, or threatening to blackmail any person connected with the conduct of the examination, or

(ii) impersonating, or

(iii) procuring impersonation by any person, or

(iv) submitting fabricated documents or documents which have been tampered with, or

(v) making statements which are incorrect or false or suppressing material information, or

(vi) resorting to the following means in connection with his/her candidature for the examination, namely
   (a) obtaining copy of question paper through improper means,
   (b) finding out the particulars of the persons connected with secret work relating to the examination.
   (c) influencing the examiners, or

(vii) using unfair means during the examination, or

(viii) writing obscene matter or drawing obscene sketches in the scripts, or

(ix) misbehaving in the examination hall including tearing of the scripts, provoking fellow examinees to boycott examination, creating a disorderly scene and the like, or

(x) harassing or doing bodily harm to the staff employed by the Commission for the conduct of their examinations, or

(xi) being in possession of or using mobile phone, bluetooth or any electronic equipment or device or any other equipment capable of being used as a communication device during the examination; or

(xii) violating any of the instructions issued to candidates along with their admission certificates permitting them to take the examination, or

(xiii) attempting to commit or as the case may be abetting the commission of all or any of the acts specified in the foregoing clauses; may in addition to rendering himself/herself liable to criminal prosecution, be liable 
   (a) to be disqualified by the Commission from the examination for which he/she is a candidate and/or
   (b) to be debarred either permanently or for a specified period
      (i) by the Commission from any examination or selection held by them;
      (ii) by the Central Government from any employment under them; and
   (c) service under Government to if he/she is already in disciplinary action under the appropriate rules.

Provided that no penalty under these rules shall be imposed except after

(i) giving the candidate an opportunity of making such representation, in writing as he/she may wish to make in that behalf; and

(ii) taking the representation, if any, submitted by the candidate within the period allowed to him/her into consideration.

6. LAST DATE FOR SUBMISSION OF APPLICATIONS:
The Online Applications can be filled upto 17th March, 2017 till 18.00 Hours.

7. CORRESPONDENCE WITH THE COMMISSION:
The Commission will not enter into any correspondence with the candidates about their candidature except in the following cases:

(i) The eligible candidates shall be issued an e-Admit Card about three weeks before the commencement of the examination. The e-Admit Card will be made available in the UPSC website [www.upsc.gov.in] for downloading by candidates. No Admission Certificate will be sent by post. If a candidate does not receive his/her e-Admit Card or any other communication regarding his/her candidature for the examination three weeks before the commencement of the examination, he/she should at once contact the Commission. Information in this regard can also be obtained from the Facilitation Counter located in the Commission’s office either in person or over phone Nos. 011- 23381125/011-23385271/011-23098543.

In case no communication is received in the Commission’s office from the candidate regarding non-receipt of his/her e-Admit Card at least three weeks before the examination, he/she himself/herself will be solely responsible for non-receipt of his/her e-Admission Certificate.

No candidate will ordinarily be allowed to take the examination unless he/she holds an e-certificate of admission for the examination. On receipt of e-Admit Card, candidates should check it carefully and bring discrepancies/errors, if any, to the notice of UPSC immediately. The candidates should note that their admission to the examination will be purely provisional based on the information given by them in the Application Form. This will be subject to verification of all the eligibility conditions by the UPSC.
The mere fact that a certificate of admission to the Examination has been issued to a candidate, will not imply that his/her candidature has been finally cleared by the Commission or that entries made by the candidate in his/her application for the Preliminary examination have been accepted by the Commission as true and correct. Candidates may note that the Commission takes up the verification of eligibility conditions of a candidate, with reference to original documents, only after the candidate has qualified for Indian Forest Service (Main) Examination. Unless candidature is formally confirmed by the Commission, it continues to be provisional.

The decision of the Commission as to the eligibility or otherwise of a candidate for admission to the Examination shall be final. Candidates should note that the name in the e-Admit Card in some cases may be abbreviated due to technical reasons.

(ii) In the event of a candidate downloading more than one e-Admit Card from the website of the Commission, he/she should use only one of these e-Admit Cards for appearing in the examination and report about the other(s) to the Commission Office.

(iii) Candidates are informed that as the Preliminary Examination is only a screening test, no marks sheets will be supplied to successful or unsuccessful candidates and no correspondence will be entertained by the Commission, in this regard.

(iv) Candidates must ensure that their E-mail IDs given in their online Applications are valid and active as the Commission may use electronic mode of communication while contacting them at different stages of the examination process.

**IMPORTANT** : ALL COMMUNICATIONS TO THE COMMISSION SHOULD INVARIABLY CONTAIN THE FOLLOWING PARTICULARS.

1. **NAME AND YEAR OF THE EXAMINATION**
2. **REGISTRATION I.D. (RID)**
3. **ROLL NUMBER (IF RECEIVED)**
4. **NAME OF CANDIDATE (IN FULL AND IN BLOCK LETTERS)**
5. **COMPLETE POSTAL ADDRESS AS GIVEN IN THE APPLICATION.**
6. **VALID AND ACTIVE E-MAIL I.D.**

**N.B.I:** COMMUNICATION NOT CONTAINING THE ABOVE PARTICULARS MAY NOT BE ATTENDED TO.

**N.B.II :** IF A LETTER/COMMUNICATION IS RECEIVED FROM A CANDIDATE AFTER AN EXAMINATION HAS BEEN HELD AND IT DOES NOT GIVE HIS/HER FULL NAME AND ROLL NUMBER, IT WILL BE IGNORED AND NO ACTION WILL BE TAKEN THEREON.

**N.B.III :** CANDIDATES ARE STRONGLY ADVISED TO KEEP A PRINTOUT OR SOFT COPY OF THEIR ONLINE APPLICATION FOR FUTURE REFERENCES.

8. The eligibility for availing reservation against the vacancies reserved for the physically disabled persons shall be the same as prescribed in "The Persons with Disability (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995."

Provided further that the physically disabled candidates shall also be required to meet special eligibility criteria in terms of physical requirements/functional classification (abilities/disabilities) consistent with requirements of the identified Service/Post as may be prescribed by its Cadre Controlling Authority. A list of Services identified suitable for Physically Disabled Category along with the physical requirements and functional classifications.

The physical requirement and functional classification can for example be one or more of the following:

**Code Physical Requirements**

<table>
<thead>
<tr>
<th>Code</th>
<th>Functional Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF</td>
<td>1. Work performed by Manipulation by Fingers</td>
</tr>
<tr>
<td>PP</td>
<td>2. Work Performed by Pulling &amp; Pushing</td>
</tr>
<tr>
<td>L</td>
<td>3. Work Performed by Lifting</td>
</tr>
<tr>
<td>KC</td>
<td>4. Work Performed by Kneeling and Crouching</td>
</tr>
<tr>
<td>BN</td>
<td>5. Work Performed by Bending</td>
</tr>
<tr>
<td>S</td>
<td>6. Work Performed by Sitting (on bench or chair)</td>
</tr>
<tr>
<td>ST</td>
<td>7. Work Performed by Standing</td>
</tr>
<tr>
<td>W</td>
<td>8. Work Performed by Walking</td>
</tr>
<tr>
<td>SE</td>
<td>9. Work Performed by Seeing</td>
</tr>
<tr>
<td>H</td>
<td>10. Work Performed by Hearing/Speaking</td>
</tr>
<tr>
<td>RW</td>
<td>11. Work Performed by Reading and Writing</td>
</tr>
<tr>
<td>C</td>
<td>12. Communication</td>
</tr>
</tbody>
</table>

**Code**

<table>
<thead>
<tr>
<th>Code</th>
<th>Functional Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL</td>
<td>1. Both legs affected but not arms</td>
</tr>
<tr>
<td>BA</td>
<td>2. Both arms affected</td>
</tr>
<tr>
<td></td>
<td>a. impaired Reach</td>
</tr>
<tr>
<td></td>
<td>b. weakness of Grip.</td>
</tr>
<tr>
<td></td>
<td>c. ataxic</td>
</tr>
<tr>
<td>BLA</td>
<td>3. Both legs and both arms affected.</td>
</tr>
<tr>
<td>OL</td>
<td>4. One leg affected (R or L)</td>
</tr>
<tr>
<td></td>
<td>a. impaired reach</td>
</tr>
<tr>
<td></td>
<td>b. weakness of grip</td>
</tr>
</tbody>
</table>
c. ataxic
OA  5. One arm affected (R or L)
   a. impaired reach
   b. weakness of grip
   c. ataxic
OAL  6. One arm and one leg affected
MW  7. Muscular weakness.
B  8. Blind
LV  9. Low vision
H  10. Hearing

Note: The above list is subject to revision from time to time.

9. NO REQUEST FOR WITHDRAWAL OF CANDIDATURE RECEIVED FROM A CANDIDATE AFTER HE/SHE HAS
   SUBMITTED HIS/HER APPLICATION WILL BE ENTERTAINED UNDER ANY CIRCUMSTANCES.
10. Details about the scheme of examination, standard and syllabi of the subjects etc. may be seen in
    Appendix-I of this Notice.

APPENDIX I

SECTION I

PLAN OF EXAMINATION

The competitive examination comprises two successive stages:

(i) Civil Services (Preliminary) Examination (Objective Type) for the screening & selection of candidates for
Indian Forest Service (Main) Examination; and

(ii) Indian Forest Service (Main) Examination (Written and Interview) for the selection of candidates
against the vacancies identified and reported for the Indian Forest Service Examination.

2. The preliminary Examination will consist of two papers of Objective type (multiple choice questions) and
carry a maximum of 400 marks in the subjects set out in sub-section (A) of Section II. This examination is
meant to serve as a screening test only; the marks obtained in the Preliminary Examination by the candidates
who are declared qualified for admission to the Main Examination will not be counted for determining their
final order of merit. The number of candidates to be admitted to the Main Examination will be about twelve
to thirteen times the total approximate number of vacancies to be filled in the year through this examination.
Only those candidates who are declared by the Commission to have qualified in the Preliminary Examination
in the year will be eligible for admission to the Main Examination of that year provided they are otherwise
eligible for admission, to the Main Examination.

Note I: Since there may be common candidates for Civil Services Examination and the Indian Forest Service
Examination, after the common Screening Test done through Civil Services (Preliminary)
Examination, separate lists will be prepared for the candidates eligible to appear in the Civil Service
(Main) Examination and Indian Forest Service (Main) Examination, based on the criterion of
minimum qualifying marks of 33% in General Studies Paper-II of Civil Services (Preliminary)
Examination and total qualifying marks of General Studies Paper-I of Civil Services
(Preliminary) Examination as determined by the Commission on the number of vacancies to be
filled through the Civil Services Examination and Indian Forest Service Examination.

Note II: There will be negative marking for incorrect answers (as detailed below) for all questions except
some of the questions where the negative marking will be inbuilt in the form of different marks
being awarded to the most appropriate and not so appropriate answer for such questions.

(i) There are four alternatives for the answers to every question. For each question for which a wrong
answer has been given by the candidate, one-third of the marks assigned to that question will be deducted as
penalty.
(ii) If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given
answers happen to be correct and there will be same penalty as above for that question.
(iii) If a question is left blank i.e. no answer is given by the candidate, there will be no penalty for that
question.

3. The Main Examination will consist of written examination and an interview test. The written examination
will consist of 6 papers of conventional essay type in the subjects set out in sub-section (B) of Section II. Also
see Note (ii) under para I of Section II(B).

4. Candidates who obtain such minimum qualifying marks in the written part of the Main Examination as
may be fixed by the Commission at their discretion, shall be summoned by them for an interview for a
Personality Test vide sub-section ‘C’ of Section II. The number of candidates to be summoned for interview
will be about twice the number of vacancies to be filled.
The interview will carry 300 marks (with no minimum qualifying marks).
Marks thus obtained by the candidates in the Main Examination (written part as well as interview) would
determine their final ranking.

SECTION II

Scheme and subjects for the Preliminary and Main Examination.
A. PRELIMINARY EXAMINATION:
The Examination shall comprise of two compulsory Papers of 200 marks each.

Note:
(i) Both the question papers will be of the objective type (multiple choice questions).
(ii) The General Studies Paper-II of the Civil Services (Preliminary) Examination will be a qualifying paper with minimum qualifying marks fixed at 33%.
(iii) The question papers will be set both in Hindi and English.
(iv) Details of the syllabi are indicated in Part A of Section III.
(v) Candidates must write the papers in their own hand. In no circumstances will they be allowed the help of a scribe to write the answers for them. However, Low Vision candidates (minimum 40% impairment) will be allowed to write the examination with the help of a scribe. Low Vision candidates will also be allowed an extra time of forty minutes for each paper @ twenty minutes per hour. Each paper will be of two hours duration.

B. MAIN EXAMINATION:

(A) The written examination consisting of the following papers:-

<table>
<thead>
<tr>
<th>Paper</th>
<th>Subject</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>General English</td>
<td>300</td>
</tr>
<tr>
<td>II</td>
<td>General Knowledge</td>
<td>300</td>
</tr>
<tr>
<td>III</td>
<td>Any two subjects to be selected from the list of for each</td>
<td>200</td>
</tr>
<tr>
<td>IV</td>
<td>the optional subjects set out in para 2 below.</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Each subject will have two papers.</td>
<td></td>
</tr>
</tbody>
</table>

(B) Interview for Personality Test (See Part (C) of Section II of this Appendix) of such candidates as may be called by the Commission.

Maximum Marks : 300 Marks

2. List of optional subjects:
(i) Agriculture
(ii) Agricultural Engineering
(iii) Animal Husbandry & Veterinary Science
(iv) Botany
(v) Chemistry
(vi) Chemical Engineering
(vii) Civil Engineering
(viii) Forestry
(ix) Geology
(x) Mathematics
(xi) Mechanical Engineering
(xii) Physics
(xiii) Statistics
(xiv) Zoology

Provided that the candidates will not be allowed to offer the following combination of subjects:
(a) Agriculture and Agricultural Engg.
(b) Agriculture and Animal Husbandry & Veterinary Science.
(c) Agriculture and Forestry.
(d) Chemistry and Chemical Engg.
(e) Mathematics and Statistics.
(f) Of the Engineering subjects viz. Agricultural Engineering, Chemical Engineering, Civil Engineering and Mechanical Engineering- not more than one subject;

NOTE - The standard and syllabi of the subjects mentioned above are given in Section III to this appendix.

General:
1. All the question papers for the examination will be of conventional (essay) type.
2. ALL QUESTION PAPERS MUST BE ANSWERED IN ENGLISH. QUESTION PAPERS WILL BE SET IN ENGLISH ONLY.
3. The duration of each of the papers referred to above will be three hours.
4. Candidates must write the papers in their own hand. In no circumstances will they be allowed the help of a scribe to write the answers for them. However, Low Vision candidates (minimum 40% impairment) will be allowed to write the examination with the help of a scribe. Low Vision candidates will also be allowed an extra time of sixty minutes for each paper @ twenty minutes per hour. Each paper will be of three hours duration.

Note (1): The eligibility conditions of a scribe, his/her conduct inside the examination hall and the manner in which and extent to which he/she can help the Low Vision candidate in writing the Indian Forest Service Examination shall be governed by the instructions issued by the UPSC in this regard. Violation of all or any of the said instructions shall entail the cancellation of the
candidature of the Low Vision candidate in addition to any other action that the UPSC may take against the scribe.

**Note (2):** For purpose of these rules the candidate shall be deemed to be a Low Vision candidate if the percentage of visual impairment is forty per cent (40%) or more. However, the extent of visual impairment should have to be corroborated by a certificate in the prescribed proforma from a Medical Board constituted by the Central/State Government along with their Detailed Application Form.

**Note (3):** The concession admissible to Low Vision candidates shall not be admissible to those suffering from Myopia.

5. The Commission have discretion to fix qualifying marks in any or all the papers of the examination.
6. If a candidate's handwriting is not easily legible, deduction will be made on this account from the total marks otherwise accruing to him/her.
7. Marks will not be allotted for mere superficial knowledge.
8. Credit will be given for orderly, effective and exact expression combined with due economy of words in all subjects of the examination.
9. In the question papers, wherever required, SI units will be used.
10. Candidates should use only international form of Indian numerals (e.g. 1, 2, 3, 4, 5, 6, etc.) while answering question papers.
11. Candidates will be allowed the use of Scientific (Non-programmable type) calculators at the conventional type examinations of UPSC. Programmable type calculators will however not be allowed and the use of such calculators shall tantamount to resorting to unfair means by the candidates. Loaning and interchanging of calculators in the Examination Hall is not permitted.

(C) PERSONALITY TEST

The candidate will be interviewed by a Board of competent and unbiased observers who will have before them a record of his/her career. The object of the Interview is to assess the personal suitability of the candidate for the Service. The candidate will be expected to have taken an intelligent interest not only in his/her subjects of academic study but also in events which are happening around him/her both within and outside his/her own state or country, as well as in modern currents of thoughts and in new discoveries which should rouse the curiosity of well educated youth.

2. The technique of the interview is not that of a strict cross examination, but of a natural, though directed and purposive conversation, intended to reveal mental qualities of the candidate. The Board will pay special attention to assessing the intellectual curiosity, critical powers of observation and assimilation, balance of judgment and alertness of mind, initiative, tact, capacity for leadership; the ability for social cohesion, mental and physical energy and powers of practical application; integrity of character; and other qualities such as topographical sense, love for out-door life and the desire to explore unknown and out of way places.

SECTION III

SYLLABI FOR THE EXAMINATION

**NOTE:** Candidates are advised to go through the Syllabus published in this Section for the Preliminary Examination and the Main Examination.

**Part A-Preliminary Examination**

**Paper I - (200 marks) Duration : Two hours**
- Current events of national and international importance
- History of India and Indian National Movement
- Indian and World Geography- Physical, Social, Economic Geography of India and the World.
- Indian Polity and Governance- Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.
- Economic and Social Development- Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, etc.
- General issues on Environmental ecology, Bio-diversity and Climate Change - that do not require subject specialization.
- General Science.

**Paper II- (200 marks) Duration : Two hours**
- Comprehension
- Interpersonal skills including communication skills;
- Logical reasoning and analytical ability
- Decision making and problem solving
- General mental ability
- Basic numeracy (numbers and their relations, orders of magnitude, etc.) (Class X level), Data interpretation (charts, graphs, tables, data sufficiency etc. - Class X level)

**Note 1:** Paper-II of the Civil Services (Preliminary) Examination will be a qualifying paper with minimum qualifying marks fixed at 33%.

**Note 2 :** The questions will be of multiple choice, objective type.

**Note 3:** It is mandatory for the candidate to appear in both the Papers of Civil Services (Prelim) Examination for the purpose of evaluation. Therefore a candidate will be disqualified in case he/she does not appear in both the papers of Civil Services (Prelim) Examination.
Part B-Main Examination
The standard of papers in General English and General Knowledge will be such as may be expected of a Science or Engineering graduate of an Indian University.


There will be no practical examination in any of the subjects.

GENERAL ENGLISH
Candidates will be required to write an essay in English. Other questions will be designed to test their understanding of English and workmanlike use of words. Passages will usually be set for summary or precis.

GENERAL KNOWLEDGE
General Knowledge including knowledge of current events and of such matters of every day observation and experience in their scientific aspects as may be expected of an educated person who has not made a special study of any scientific subject. The paper will also include questions on Indian Polity including the political system and the Constitution of India, History of India and Geography of a nature which the candidate should be able to answer without special study.

OPTIONAL SUBJECTS
Total number of questions in the question papers of optional subjects will be eight. All questions will carry equal marks. Each paper will be divided into two parts, viz. Part A and Part B, each part containing four questions. Out of eight questions, five questions are to be attempted. One question in each part will be compulsory. Candidates will be required to answer three more questions out of the remaining six questions, taking at least one question from each Part. In this way, at least two questions will be attempted from each Part i.e. one compulsory question plus one more.

AGRICULTURE
PAPER-I
Ecology and its relevance to man, natural resources, their sustainable management and conservation. Physical and social environment as factors of crop distribution and production. Climatic elements as factors of crop growth, impact of changing environment on cropping pattern as indicators of environments. Environmental pollution and associated hazards to crops, animals, and humans. Cropping pattern in different agro-climatic zones of the country. Impact of high-yielding and short-duration varieties on shifts in cropping pattern. Concepts of multiple cropping, multistorey, relay and intercropping, and their importance in relation to food production. Package of practices for production of important cereals, pulses, oil seeds, fibres, sugar, commercial and fodder crops grown during Kharif and Rabi seasons in different regions of the country. Important features, scope and propagation of various types of forestry plantations such as extension, social forestry, agro-forestry, and natural forests. Weeds, their characteristics, dissemination and association with various crops; their multiplication; cultural, biological and chemical control of weeds. Soil-physical, chemical and biological properties. Processes and factors of soil formation. Modern classification of Indian soils, Mineral and organic constituents of soils and their role in maintaining soil productivity. Essential plant nutrients and other beneficial elements in soils and plants. Principles of soil fertility and its evaluation for judicious fertilizer use, integrated nutrient management. Losses of nitrogen in soil, nitrogen-use efficiency in submerged rice soils, nitrogen fixation in soils. Fixation of phosphorus and potassium in soils and the scope for their efficient use. Problem soils and their reclamation methods. Soil conservation planning on watershed basis. Erosion and run-off management in hilly, foot hills, and valley lands; processes and factors affecting them. Dry land agriculture and its problems. Technology of stabilising agriculture production in rain fed agriculture area. Water-use efficiency in relation to crop production, criteria for scheduling irrigations, ways and means of reducing run-off losses of irrigation water. Drip and sprinkler irrigation. Drainage of waterlogged soils, quality of irrigation water, effect of industrial effluents on soil and water pollution. Farm management, scope, important and characteristics, farm planning. Optimum resources use and budgeting. Economics of different types of farming systems. Marketing and pricing of agricultural inputs and outputs, price fluctuations and their cost; role of cooperatives in agricultural economy; types and systems of farming and factors affecting them. Agricultural extension, its importance and role, methods of evaluation of extension programmes, socio-economic survey and status of big, small, and marginal farmers and landless agricultural labourers; farm mechanization and its role in agricultural production and rural employment. Training programmes for extension workers; lab-to-land programmes.

PAPER-II
Cell Theory, cell structure, cell organelles and their function, cell division, nucleic acids-structure and function, gene structure and function. Laws of heredity, their significance in plant breeding. Chromosome structure, chromosomal aberrations, linkage and cross-over, and their significance in recombination breeding. Polyploidy, euploid and an euploids. Mutation-micro and macro-and their role in crop improvement. Variation, components of variation. Heritability, sterility and incompatibility, classification and
their application in crop improvement. Cytoplasmic inheritance, sex-linked, sex influenced and sex-limited characters.


Seed technology, its importance. Different kinds of seeds and their seed production and processing techniques. Role of public and private sectors in seed production, processing and marketing in India. Physiology and its significance in agriculture. Imbibition, surface tension, diffusion and osmosis. Absorption and translocation of water, transpiration and water economy. Enzymes and plant pigments; photosynthesis-modern concepts and factors affecting the process; aerobic and non-aerobic respiration; C, C and CAM mechanisms. Carbohydrate, protein and fat metabolism.

Growth and development; photo-periodism and vernalization. Auxins, hormones, and other plant regulators and their mechanism of action and importance in agriculture. Physiology of seed development and germination; dormancy.

Climatic requirements and cultivation of major fruits, plants, vegetable crops and flower plants; the package of practices and their scientific basis. Handling and marketing problems of fruit and vegetables. Principal methods of preservation of important fruits and vegetable products, processing techniques and equipment. Role of fruits and vegetables in human nutrition. Raising of ornamental plants, and design and layout of lawns and gardens.


Storage pests and diseases of cereals and pulses, and their control. Food production and consumption trends in India. National and international food policies. Production, procurement, distribution and processing constraints. Relation of food production to national dietary pattern, major deficiencies of calorie and protein.

**AGRICULTURAL ENGINEERING**

**PAPER - I**

**SECTION A**


2. **Aerial Photography and Remote Sensing** : Basic characteristics of photographic images, interpretation keys, equipment for interpretation, imagery interpretation for land use, geology, soil and forestry. Remote sensing - merits and demerits of conventional and remote sensing approaches. Types of satellite images, fundamentals of satellite image interpretation, techniques of visual and digital interpretations for soil, water and land use management. Use of GIS in planning and development of watersheds, forests including forest cover, water resources etc.

**SECTION B**


4. **Agricultural Structures**: Site selection, design and construction of farmstead - farm house, cattle shed, dairy barn, poultry shed, hog housing, machinery and implement shed, storage structures for food grains, feed and forage. Design and construction of fences and farm roads. Structures for plant environment – green houses, poly houses and shade houses. Common building materials used in construction - timber, brick, stone, tiles, concrete etc and their properties. Water supply, drainage and sanitation system.

**PAPER-II**

**Section A**


**ANIMAL HUSBANDRY AND VETERINARY SCIENCE**

**PAPER-I**

1. **Animal Nutrition**: Energy sources, energy, metabolism and requirements for maintenance and production of milk, meat, eggs and wool. Evaluation of feeds as sources of energy.
   1.2. Minerals in animal diet: Sources, functions, requirements and their relationship of the basic minerals nutrients including trace elements.
   1.3. Vitamins, Hormones and Growth Stimulating substances: Sources, functions, requirements and inter-relationship with minerals.
   1.5 Advances in Non-Ruminant Nutrition-Poultry-Nutrients and their metabolism with reference to poultry, meat and egg production, Nutrients requirements and feed formulation and broilers at different ages.
   1.6 Advances in Non-Ruminant Nutrition-Swine-Nutrients and their metabolism with special reference to growth and quality of meat production, Nutrient requirement and feed formulation for baby-growing and finishing pigs.

2. **Animal Physiology**:
   2.2 Milk Production and Reproduction and Digestion: Current status of hormonal control of mammary development, milk secretion and milk ejection. Male and Female reproduction organ, their components and function. Digestive organs and their functions.
2.3 Environmental Physiology: Physiological relations and their regulation; mechanisms of adaptation, environmental factors and regulatory mechanism involved in animal behaviour, methods of controlling climatic stress.


Detection of estrus and time of insemination for better conception.

3. Livestock Production and Management:

3.1 Commercial Dairy Farming-Comparison of dairy farming in India with advanced countries. Dairying under fixed farming and as a specialised farming, economic dairy farming, Starting of a dairy farm. Capital and land requirement, organisation of the dairy farm.

Procurement of goods; opportunities in dairy farming, factors determining the efficiency of dairy animal, Herd recording, budgeting, cost of milk production; pricing policy; Personnel Management. Developing Practical and Economic ration for dairy cattle; supply of greens throughout the year, field and fodder requirements of Dairy Farm, Feeding regimes for day and young stock and bulls, heifers and breeding animals, new trends in feeding young and adult stock; Feeding records.


3.3 Feeding and management of animals under drought, flood and other natural calamities.

4. Genetics and Animal Breeding: Mitosis and Meiosis; Mendelian inheritance; deviations to Mendelian genetics; Expression of genes; Linkage and crossing over; Sex determination, sex influenced and sex limited characters; Blood groups and polymorphism; Chromosome aberrations; Gene and its structure; DNA as a genetic material; Genetic code and protein synthesis; Recombinant DNA technology, Mutations, types of mutations, methods for detecting mutations and mutation rate.

4.1 Population Genetics Applied to Animal Breeding: Quantitative Vs. qualitative traits; Hardy Weinberg Law; Population Vs. individual; Gene and genotypic frequency; Forces changing gene frequency; Random drift and small populations; Theory of path coefficient; Inbreeding, methods of estimating inbreeding coefficient, systems of inbreeding: Effective population size; Breeding value, estimation of breeding value, dominance and epistatic deviation; partitioning of variation; Genotype X environment correlation and genotype X environment interaction; Role of multiple measurements; Resemblance between relatives.

4.2 Breeding Systems: Heritability, repeatability and genetic and phenotypic correlations, their methods of estimation and precision of estimates; Aids to selection and their relative merits; Individual, pedigree, family and within family selection; Progeny testing; Methods of selection; Construction of selection indices and their uses; Comparative evaluation of genetic gains through various selection methods; Indirect selection and Correlated response; Inbreeding, upgrading, cross-breeding and synthesis of breeds; Crossing of inbred lines for commercial production; Selection for general and specific combining ability; Breeding for threshold character.

Paper II

1. Health and Hygiene


1.3 Bovine Anatomy-Regional Anatomy: Paranasal sinuses of OX-surface anatomy of salivary glands. Regional anatomy of infraorbital, maxillary, mandibuloalveolar, mental & coronal nerve block-Regional anatomy of para-vertebral nerves, pudendal nerve, median, ulnar & radial nerves-tibial, fibular and digital nerves-Cranial nerves-structures involved in epidural anaesthesia-superficial lymph nodes-surface anatomy of visceral organs of thoracic, abdominal and pelvic cavities-comparative features of locomotor apparatus & their application in the biomechanics of mammalian body.

1.4 Anatomy of Fowl: Musculo-skeletal system-functional anatomy in relation to respiration and flying, digestion and egg production.

1.5 Physiology of blood and its circulation, respiration; excretion, Endocrine glands in health and disease.


1.5.3 Respiration: Mechanism of respiration, Transport and exchange of gases—neural control of respiration—chemo receptors—hypoxia—respiration in birds.


1.5.5 Endocrine glands: Functional disorders, their symptoms and diagnosis. Synthesis of hormones, mechanism and control of secretion—hormonal receptors classification and function.

1.6 General knowledge of pharmacology and therapeutics of drugs: Cellular level of pharmacodynamics and pharmaco-kinetics—Drugs acting on fluids and electrolyte balance—drugs acting on Autonomic nervous system—Modern concepts of anaesthesia and dissociative Anaesthetics—Autocoids—Antimicrobials and principles of chemotherapy in microbial injections—use of hormones in therapeutics—chemotherapy of parasitic infections—Drug and economic persons in the Edible tissues of animals—chemotherapy of Neoplastic diseases.

1.7 Veterinary Hygiene with reference to water, air and habitation: Assessment of pollution of water, air and soil—Importance of climate in animal health—effect of environment on animal function and performance—relationship between industrialization and animal agriculture—animal housing requirements for specific categories of domestic animals viz. pregnant cows & sows, milking cows, broiler birds—stress, strain & productivity in relation to animal habitation.

2. Animal Diseases:

2.1 Pathogenesis, symptoms, postmortem lesions, diagnosis, and control of infection diseases of cattle, pigs and poultry, horses, sheep and goats.

2.2 Etiology, symptoms, diagnosis, treatment of production diseases of cattle, pig and poultry.

2.3 Deficiency diseases of domestic animals and birds.

2.4 Diagnosis and treatment of nonspecific condition like impaction, Bloat, Diarrhoea, Indigestion, dehydration, stroke, poisoning.

2.5 Diagnosis and treatment of neurological disorders.

2.6 Principles and methods of immunization of animals against specific diseases-hard immunity—disease free zones—‘zero’ disease concept—chemoprophylaxis.

2.7 Anesthesia—local, regional and general—pre-anesthetic medication, Symptoms and surgical interference in fractures and dislocation, Hernia, choking, abomassal displacement—Caesarian operations, Rumenotomy—Castrations.

2.8 Disease investigation techniques—Materials for laboratory investigation—Establishment Animal Health Centres—Disease free zone.

3. Veterinary Public Health

3.1 Zoonoses: Classification, definition; role of animals and birds in prevalence and transmission of zoonotic diseases occupational zoonotic diseases.

3.2. Epidemiology: Principles, definition of epidemiological terms, application of epidemiological measures in the study of diseases and disease control, Epidemiological features of air, water and food borne infections.


4. Milk and Milk Products Technology:


4.2 Milk Products Technology: Selection of raw materials, assembling, production, processing, storing, distributing and marketing milk products such as Butter, Ghee, Khoya, Channa, Cheese; Condensed, evaporated, dried milk and baby food; Ice cream and Kulfi; by products; whey products, butter milk, lactose and casein. Testing Grading, judging milk products-BIS and Agmark specifications, legal standards, quality control nutritive properties. Packaging, processing and operational control Costs.
5. Meat Hygiene and Technology:

5.1 Meat Hygiene:
5.1.1 Ante mortem care and management of food animals, stunning, slaughter and dressing operations; abattoir requirements and designs; Meat inspection procedures and judgement of carcass meat cuts-drading of carcass meat cuts-duties and functions of Veterinarians in Wholesome meat production.
5.1.2 Hygienic methods of handling production of meat-spoilage of meat and control measures-Post slaughter physicochemical changes in meat and factors that influence them-quality improvement methods-Adulteration of meat and defeciton-Regulatory provisions in Meat trade and Industry.

5.2. Meat Technology
5.2.1 Physical and chemical characteristics of meat-meat emulsions-methods of preservation of meat-curing, canning, irradiation, packaging of meat and meat products; meat products and formulations.

5.3. Byproducts: Slaughter house by products and their utilisation-Edible and inedible byproducts-social and economic implications of proper utilisation of slaughter house byproducts-Organ products for food and pharmaceuticals.


BOTANY
PAPER-I


4. Plant Utility and Exploitation:


PAPER-II


2. Genetics, Molecular Biology and Evolution: Development of genetics, and gene versus allele concepts (Pseudo alleles). Quantitative genetics and multiple factors. Linkage and crossing over-methods of gene mapping including molecular maps (idea of mapping function). Sex chromosomes and sex linked inheritance, sex determination and molecular basis of sex differentiation. Mutation (biochemical and molecular basis).
Cytoplasmic inheritance and cytoplasmic genes (including genetics of male sterility). Prions and prion hypothesis.
Organic evolution-evidences, mechanism and theories. Role of RNA in origin and evolution.


CHEMISTRY
PAPER-I

1. Atomic structure
Quantum theory. Heisenberg's uncertainty principle, Schrödinger wave equation (time independent). Interpretation of wave function, particle in one-dimensional box, quantum numbers, hydrogen atom wave functions. Shapes of s, p and d orbitals.

2. Chemical bonding
Ionic bond, characteristics of ionic compounds, factors affecting stability of ionic compounds, lattice energy, Born-Haber cycle; covalent bond and its general characteristics, polarities of bonds in molecules and their dipole moments. Valence bond theory, concept of resonance and resonance energy. Molecular orbital theory (LCAO method); bonding in homonuclear molecules: H2+, H2 to Ne2, NO, CO, HF, CN, CN-, BeH2 and CO2. Comparison of valence bond and molecular orbital theories, bond order, bond strength and bond length.

3. SOLID STATE

4. The gaseous state
Equation of state for real gases, intermolecular interactions, liquefaction of gases and critical phenomena, Maxwell's distribution of speeds, intermolecular collisions, collisions on the wall and effusion.

5. Thermodynamics and statistical thermodynamics
Thermodynamic systems, states and processes, work, heat and internal energy; first law of thermodynamics, work done on the systems and heat absorbed in different types of processes; calorimetry, energy and enthalpy changes in various processes and their temperature dependence. Second law of thermodynamics; entropy as a state function, entropy changes in various process, entropy-reversibility and irreversibility. Free energy functions; criteria for equilibrium, relation between equilibrium constant and thermodynamic quantities; Nernst heat theorem and third law of thermodynamics. Micro and macro states; canonical ensemble and canonical partition function; electronic, rotational and vibrational partition functions and thermodynamic quantities; chemical equilibrium in ideal gas reactions.

6. Phase equilibria and solutions
Phase equilibria in pure substances; Clausius-Clapeyron equation; phase diagram for a pure substance; phase equilibria in binary systems, partially miscible liquids-upper and lower critical solution temperatures; partial molar quantities, their significance and determination; excess thermodynamic functions and their determination.

7. Electrochemistry
Debye-Huckel theory of strong electrolytes and Debye-Huckel limiting Law for various equilibrium and transport properties.
Galvanic cells, concentration cells; electrochemical series, measurement of e.m.f. of cells and its applications fuel cells and batteries.
Processes at electrodes; double layer at the interface; rate of charge transfer, current density; overpotential; electroanalytical techniques-voltametry, polarography, amperometry, cyclic-voltametry, ion selective electrodes and their use.

8. Chemical kinetics
Concentration dependence of rate of reaction; differential and integral rate equations for zeroth, first, second and fractional order reactions. Rate equations involving reverse, parallel, consecutive and chain reactions; effect of temperature and pressure on rate constant. Study of fast reactions by stop-flow and relaxation methods. Collisions and transition state theories.

9. Photochemistry
Absorption of light; decay of excited state by different routes; photochemical reactions between hydrogen and halogens and their quantum yields.

10. Surface phenomena and catalysis
Adsorption from gages and solutions on solid adsorbents, adsorption isotherms-Langmuir and B.E.T. isotherms; determination of surface area, characteristics and mechanism of reaction on heterogeneous catalysts.

11. Bio-inorganic chemistry
Metal ions in biological systems and their role in ion-transport across the membranes (molecular mechanism), ionophores, photosynthesis-PSI, PSII; nitrogen fixation, oxygen-uptake proteins, cytochromes and ferredoxins.

12. Coordination chemistry
(a) Electronic configurations; introduction to theories of bonding in transition metal complexes. Valence bond theory, crystal field theory and its modifications; applications of theories in the explanation of magnetism and electronic spectra of metal complexes.
(b) Isomerism in coordination compounds. IUPAC nomenclature of coordination compounds; stereochemistry of complexes with 4 and 6 coordination numbers; chelate effect and poly-nuclear complexes; trans effect and its theories; kinetics of substitution reactions in square-planer complexes; thermodynamic and kinetic stability of complexes.
(c) Synthesis and structures of metal carbonyls; carboxylate anions, carbonyl hydrides and metal nitrosoyl compounds.
(d) Complexes with aromatic systems, synthesis, structure and bonding in metal olefin complexes, alkynic complexes and cyclopentadienyl complexes; coordinative unsaturation, oxidative addition reactions, insertion reactions, fluxional molecules and their characterization. Compounds with metal-metal bonds and metal atom clusters.

13. General chemistry of f block elements
Lanthanides and actinides; separation, oxidation states, magnetic and spectral properties; lanthanide contraction.

14. Non-Aqueous Solvents
Reactions in liquid NH3, HF, SO2 and H2 SO4. Failure of solvent system concept, coordination model of non-aqueous solvents. Some highly acidic media, fluoro-sulphuric acid and super acids.

PAPER II

1. Delocalised covalent bonding: Aromaticity, anti-aromaticity; annulenes, azulenes, tropolones, kekulene, fulvenes, sydrones.

2. (a) Reaction mechanisms: General methods (both kinetic and non-kinetic) of study of mechanism or organic reactions illustrated by examples-use of isotopes, cross-over experiment, intermediate trapping, stereochemistry; energy diagrams of simple organic reactions-transition states and intermediates; energy of activation; thermodynamic control and kinetic control of reactions.

(b) Reactive intermediates: Generation, geometry, stability and reactions of carbonium and carbanion ions, carbanions, free radicals, carbenes, benzylics and nitriles.

(c) Substitution reactions: SN1, SN2, SNi, SN1', SN2', SNi' and SRN1 mechanisms; neighbouring group participation; electrophilic and nucleophilic reactions of aromatic compound including simple heterocyclic compounds-pyrrole, thiophene, indole.

(d) Elimination reactions: E1, E2 and E1cb mechanisms; orientation in E2 reactions-Saytzeff and Hoffmann; pyrolytic syn elimination-acetate pyrolysis, Chugaev and Cope eliminations.

(e) Addition reactions: Electrophilic addition to C=C and C=O, nucleophilic addition to C=O, C=N, conjugated olefins and carbonyls.


3. Pericyclic reactions: Classification and examples; Woodward-Hoffmann rules-electro-cyclic reactions, cy cloaddition reactions [2+2 and 4+2] and sigmatropic shifts [1, 3; 3, 3 and 1, 5] FMO approach.

5. Polymeric Systems

(a) Physical chemistry of polymers: Polymer solutions and their thermodynamic properties; number and weight average molecular weights of polymers. Determination of molecular weights by sedimentation, light scattering, osmotic pressure, viscosity, and group analysis methods.

(b) Preparation and properties of polymers: Organic polymers—polyethylene, polystyrene, polyvinyl chloride, Teflon, nylon, terylene, synthetic and natural rubber. Inorganic polymers—phosphonitrilic halides, borazines, silicones and silicates.

(c) Biopolymers: Basic bonding in proteins, DNA and RNA.

6. Synthetic uses of reagents: OsO₄, HIO₄, CrO₃, Pb(OAc)₄, SeO₂, NBS, B₂H₆, Na-Liquid NH₃, NaBH₄, n-BuLi, MCPBA.

7. Photochemistry: Photochemical reactions of simple organic compounds, excited and ground states, singlet and triplet states, Norrish-Type I and Type II reactions.

8. Principles of spectroscopy and applications in structure elucidation

(a) Rotational spectra—diatomic molecules; isotopic substitution and rotational constants.

(b) Vibrational spectra—diatomic molecules, linear triatomic molecules, specific frequencies of functional groups in polyatomic molecules.

(c) Electronic spectra: Singlet and triplet states. N→π* and π→π* transitions; application to conjugated double bonds and conjugated carbonyls-Woodward-Fieser rules.

(d) Nuclear magnetic resonance: Isochronous and anisochronous protons; chemical shift and coupling constants; Application of H1 NMR to simple organic molecules.

(e) Mass spectra: Parent peak, base peak, daughter peak, metastable peak, fragmentation of simple organic molecules; £-cleavage, McLafferty rearrangement.

(f) Electron spin resonance: Inorganic complexes and free radicals.

CHEMICAL ENGINEERING

PAPER-I

Section A

(a) Fluid and Particle Dynamics

(b) Mass Transfer

(c) Heat Transfer

Section B

(d) Novel Separation Processes

(e) Process Equipment Design

(f) Process Dynamics and Control

Paper-II

Section A

(a) Material and Energy Balances
Material and energy balance calculations in processes with recycle/bypass/purge. Combustion of solid/liquid/gaseous fuels, stoichiometric relationships and excess air requirements. Adiabatic flame temperature.

(b) Chemical Engineering Thermodynamics

(c) Chemical Reaction Engineering:

(d) Chemical Technology

(e) Environmental Engineering and Safety

(f) Process Engineering Economics:

CIVIL ENGINEERING
PAPER-I
Part-A : ENGINEERING MECHANICS, STRENGTH OF MATERIALS AND STRUCTURAL ANALYSIS.

ENGINEERING MECHANICS:
Units and Dimensions, SI Units, Vectors, Concept of Force, Concept of particle and rigid body. Concurrent, Non Concurrent and parallel forces in a plane, moment of force and Varignon's theorem, free body diagram, conditions of equilibrium, Principle of virtual work, equivalent force system. First and Second Moment of area, Mass moment of Inertia. Static Friction, Inclined Plane and bearings. Kinematics and Kinetics:

STRENGTH OF MATERIALS:

STRUCTURAL ANALYSIS:
Castigliano's theorems I and II, unit load method, method of consistent deformation applied to beams and pin jointed trusses. Slope-deflection, moment distribution, Kani’s method of analysis and column Analysis method applied to indeterminate beams and rigid frames. Rolling loads and Influences lines : Influences lines for Shear Force and Bending moment at a section of a beam. Criteria for maximum shear force and bending Moment in beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses. Arches : Three hinged, two hinged and fixed arches, rib shortening and temperature effects, influence lines in arches.
Plastic Analysis of beams and frames: Theory of plastic bending, plastic analysis, statical method, Mechanism method.
Unsymmetrical bending: Moment of inertia, product of inertia, position of Neutral Axis and Principle axes, calculation of bending stresses.

**Part-B**

**DESIGN OF STRUCTURES: STEEL, CONCRETE AND MASONRY STRUCTURES.**

**STRUCTURAL STEEL DESIGN:**
Structural Steel: Factors of safety and load factors. Rivetted, bolted and welded joints and connections.
Design of tension and compression members, beams of built up section, rivetted and welded plate girders, gantry girders, stanchions with battens and lacings, slab and gusseted column bases.
Design of highway and railway bridges: Through and deck type plate girder, Warren girder, Pratt truss.

**DESIGN OF CONCRETE AND MASONRY STRUCTURES:**
Recommendations of I.S. codes design of one way and two way slabs, stair-case slabs, simple and continuous beams of rectangular, T and L sections. Compression members under direct load with or without eccentricity, isolated and combined footings.
Cantilever and Counterfort type retaining walls.
Water tanks: Design requirements for Rectangular and circular tanks resting on ground.
Prestressed concrete: Methods and systems of prestressing, anchorages, Analysis and design of sections for flexure based on working stress, loss of prestress.
Design of brick masonry as per I.S. Codes.
Design of masonry retaining walls.

**Part-C**

**FLUID MECHANICS, OPEN CHANNEL FLOW AND HYDRAULIC MACHINES**

**Fluid Mechanics:** Fluid properties and their role in fluid motion, fluid statics including forces acting on plane and curve surfaces.
Kinematics and Dynamics of Fluid flow: Velocity and accelerations, stream lines, equation of continuity, irrotational and rotational flow, velocity potential and stream functions, flownet, methods of drawing flownet, sources and sinks, flow separation, free and forced vortices.
Control volume equation, continuity, momentum, energy and moment of momentum equations from control volume equation, Navier-Stokes equation, Euler’s equation of motion, application to fluid flow problems, pipe flow, plane, curved, stationary and moving vanes, sluice gates, weir, orifice meters and Venturi meters.

**Dimensional Analysis and Similitude:** Buckingham’s Pi-theorem, dimensionless parameters, similitude theory, model laws, undistorted and distorted models.

**Laminar Flow:** Laminar flow between parallel, stationary and moving plates, flow through tube.

**Boundary layer:** Laminar and turbulent boundary layer on a flat plate, laminar sub-layer, smooth and rough boundaries, drag and lift.

**Turbulent flow through pipes:** Characteristics of turbulent flow, velocity distribution and variation of pipe friction factor, hydraulic grade line and total energy line, siphons, expansion and contractions in pipes, pipe networks, water hammer in pipes and surge tanks.

**Open channel flow:** Uniform and non-uniform flows, momentum and energy correction factors, specific energy and specific force, critical depth, resistance equations and variation of roughness coefficient, rapidly varied flow, flow in contractions, flow at sudden drop, hydraulic jump and its applications surges and waves, gradually varied flow, classification of surface profiles, control section, step method of integration of varied flow equation, moving surges and hydraulic bore.

**HYDRAULIC MACHINES AND HYDROPOWER:**
Centrifugal pumps: Types, characteristics, Net Positive Suction Height (NPSH), specific speed. Pumps in parallel.
Reciprocating pumps, Airvessels, Hydraulic ram, efficiency parameters, Rotary and positive displacement pumps, diaphragm and jet pumps.
Hydraulic turbines, types classification, Choice of turbines, performance parameters, controls, characteristics, specific speed.
Principles of hydropower development. Type, layouts and Component works. Surge tanks, types and choice.

**GEO TECHNICAL ENGINEERING**
Types of soil, phase relationships, consistency limits particles size distribution, classifications of soil, structure and clay mineralogy.
Capillary water and structural water, effective stress and pore water pressure, Darcy’s Law, factors affecting permeability, determination of permeability, permeability of stratified soil deposits.
Seepage pressure, quick sand condition, compressibility and consolidation, Terzaghi’s theory of one dimensional consolidation, consolidation test.
Compaction of soil, field control of compaction. Total stress and effective stress parameters, pore pressure coefficients.
Shear strength of soils, Mohr Coulomb failure theory, Shear tests.
Earth pressure at rest, active and passive pressures, Rankine's theory, Coulomb's wedge theory, earth pressure on retaining wall, sheetpile walls, Braced excavation.
Bearing capacity, Terzaghi and other important theories, net and gross bearing pressure.
Immediate and consolidation settlement.
Stability of slope, Total Stress and Effective Stress methods, Conventional methods of slices, stability number. Subsurface exploration, methods of boring, sampling, penetration tests, pressure meter tests.
Essential features of foundation, types of foundation, design criteria, choice of type of foundation, stress distribution in soils, Boussinesq's theory, Newmark's chart, pressure bulb, contact pressure, applicability of different bearing capacity theories, evaluation of bearing capacity from field tests, allowable bearing capacity, Settlement analysis, allowable settlement.
Proportioning of footing, isolated and combined footings, rafts, buoyancy rafts, Pile foundation, types of piles, pile capacity, static and dynamic analysis, design of pile groups, pile load test, settlement of piles, lateral capacity. Foundation for Bridges. Ground improvement techniques-preloading, sand drains, stone column, grouting, soil stabilisation.

PAPER-II

CONSTRUCTION TECHNOLOGY, EQUIPMENT, PLANNING AND MANAGEMENT

1. Construction Technology :
Engineering Materials :
- Physical properties of construction materials: Stones, Bricks and Tiles; Lime, Cement and Surkhi Mortars; Lime Concrete and Cement Concrete, Properties of freshly mixed and hardened concrete, Flooring Tiles, use of ferrocement, fibre-reinforced and polymer concrete, high strength concrete and light weight concrete.
- Timber: Properties and uses; defects in timber; seasoning and preservation of timber. Plastics, rubber and damp-proofing materials, termite proofing, Materials, for Low cost housing.

Construction :
Functional planning of building: Building orientation, circulation, grouping of areas, privacy concept and design of energy efficient building; provisions of National Building Code.
Building estimates and specifications; Cost of works; valuation.

2. Construction Equipment :
- Concreting equipments: Weigh batcher, mixer, vibration, batching plant, Concrete pump.
- Earth-work equipment: Power shovel hoe, bulldozer, dumper, trailors, and tractors, rollers, sheep foot roller.

3. Construction Planning and Management: Construction activity, schedules, job layout, bar charts, organization of contracting firms, project control and supervision. Cost reduction measures.

SURVEY AND TRANSPORTATION ENGINEERING


Railways: Permanent way, sleepers, rail fastenings, ballast, points and crossings, design of turn outs, stations and yards, turntables, signals, and interlocking, level-crossing. Construction and maintenance of permanent ways: Super-elevation, creep of rail, ruling gradient, track resistance, tractive effort, relaying of track.


Part-c:
HYDROLOGY, WATER RESOURCES AND ENGINEERING:
Hydrology: Hydrological cycle, precipitation, evaporation, transpiration, depression storage, infiltration, overland flow, hydrograph, flood frequency analysis, flood estimation, flood routing through a reservoir, channel flow routing-Muskingam method.

Ground water flow: Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquitards, radial flow into a well under confined and unconfined conditions, tube wells, pumping and recapture tests, ground water potential.

WATER RESOURCES ENGINEERING: Ground and surface water resource, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation, economics of water resources projects.

IRRIGATION ENGINEERING: Water requirements of crops: consumptive use, quality of water for irrigation, duty and delta, irrigation methods and their efficiencies.

Canals: Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributory canals, most efficient section, lined canals, their design, regime theory, critical shear stress, bed load, local and suspended load transport, cost analysis of lined and unlined canals, drainage behind lining.

Water logging: causes and control, drainage system design, salinity.

Canal structures: Design of cross regulators, head regulators, canal falls, aqueducts, metering flumes and canal outlets.

Diversion head work: Principles and design of weirs of permeable and impermeable foundation, Khosla's theory, energy dissipation, stilling basin, sediment excluders.

Storage works: Types of dams, design, principles of rigid gravity and earth dams, stability analysis, foundation treatment, joints and galleries, control of seepage.

Spillways: Spillway types, crest gates, energy dissipation.

River training: Objectives of river training, methods of river training.

PART D

ENVIRONMENTAL ENGINEERING

Water Supply: Estimation of surface and subsurface water resources, predicting demand for water, impurities of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.

Intake of water: pumping and gravity schemes. Water treatment: principles of coagulation, flocculation and sedimentation; slow-, rapid-, pressure-, filters; chlorination, softening, removal of taste, odour and salinity.

Water storage and distribution: storage and balancing reservoirs: types, location and capacity.

Distribution system: layout, hydraulics of pipes lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations.

Sewage systems: Domestic and industrial wastes, storm sewage-separate and combined systems, flow through sewers, design of sewers, sewer appurtenances, manholes, inlets, junctions, siphon. Plumbing in public buildings.

Sewage characterization: BOD, COD, solids, dissolved oxygen, nitrogen and TOC. Standards of disposal in normal water course and on land.

Sewage treatment: Working principles, units, chambers, sedimentation tanks, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of waste water.

Solid waste: collection and disposal in rural and urban contexts, management of long-term ill-effects.


FORESTRY

PAPER-I

Section A

1. Silviculture - General:

General Silvicultural Principles: ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests; methods of propagation, grafting techniques; site factors; nursery and planting techniques-nursery beds, polybags and maintenance, water budgeting, grading and hardening of seedlings; special approaches; establishment and tending.

2. Silviculture - systems:

Clear felling, uniform shelter wood selection, coppice and conversion systems. Management of silviculture systems of temperate, subtropical, humid tropical, dry tropical and coastal tropical forests with special reference to plantation silviculture, choice of species, establishment and management of standards, enrichment methods, technical constraints, intensive mechanized methods, aerial seeding thinning.

3. Silviculture - Mangrove and Cold desert:

Mangrove: habitat and characteristics, mangrove, plantation-establishment and rehabilitation of degraded mangrove formations; silvicultural systems for mangrove; protection of habitats against natural disasters.

Cold desert: Characteristics, identification and management of species.

4. Silviculture of trees:

Traditional and recent advances in tropical silvicultural research and practices. Silviculture of some of the economically important species in India such as Acacia catechu, Acacia nilotica, Acacia auriculiformis, Albizzia.
Section B

1. Agroforestry, Social Forestry, Joint Forest Management and Tribology:

Agroforestry - scope and necessity; role in the life of people and domestic animals and in integrated land use, planning especially related to (i) soil and water conservation; (ii) water recharge; (iii) nutrient availability to crops; (iv) nature and ecosystem preservation including ecological balances through pest-predator relationships and (v) providing opportunities for enhancing bio-diversity, medicinal and other flora and fauna. Agro forestry systems under different agro-ecological zones; selection of species and role of multipurpose trees and NTFPs, techniques, food, fodder and fuel security. Research and Extension needs.

Social/Urban Forestry: objectives, scope and necessity; peoples participation.

Tribology - tribal scene in India; tribes, concept of races, principles of social grouping, stages of tribal economy, education, cultural tradition, customs, ethos and participation in forestry programmes.

2. Forest Soils, Soil Conservation and Watershed management:

Forests Soils: classification, factors affecting soil formation; physical, chemical and biological properties.

Soil conservation - definition, causes for erosion; types - wind and water erosion; conservation and management of eroded soils/areas, wind breaks, shelter belts; sand dunes; reclamation of saline and alkaline soils, water logged and other waste lands. Role of forests in conserving soils. Maintenance and build up of soil organic matter, provision of loppings for green leaf manuring; forest leaf litter and composting; Role of water recharge and watershed management; role of integrating forest trees, horticultural crops, field crops, watershed management and environmental functions of forests; water-harvesting and conservation; ground water recharge and watershed management; role of integrating forest trees, horticultural crops, field crops, grass and fodder.

3. Environmental Conservation and Biodiversity:

Environment; components and importance, principles of conservation, impact of deforestation; forest fires and various human activities like mining, construction and developmental projects, population growth on environment.

Pollution - types, global warming, green house effects, ozone layer depletion, acid rain, impact and control measures, environmental monitoring; concept of sustainable development. Role of trees and forests in environmental conservation; control and prevention of air, water and noise pollution. Environmental policy and legislation in India. Environmental Impact Assessment. Economics assessment of watershed development vis-a-vis ecological and environmental protection.

4. Tree Improvement and Seed Technology:

General concept of tree improvement, methods and techniques, variation and its use, provenance, seed source, exotics; quantitative aspects of forest tree improvement, seed production and seed orchards, progeny tests, use of tree improvement in natural forest and stand improvement, genetic testing programming, selection and breeding for resistance to diseases, insects, and adverse environment; the genetic base, forest genetic resources and gene conservation in situ and ex-situ. Cost benefit ratio, economic evaluation.

PAPER II

Section A

1. Forest Management and Management Systems:

Objective and principles; techniques; stand structure and dynamics, sustained yield relation; rotation, normal forest, growing stock; regulation of yield; management of forest plantations, commercial forests, forest cover monitoring. Approaches viz., (i) site-specific planning, (ii) strategic planning, (iii) Approval, sanction and expenditure, (iv) Monitoring (v) Reporting and governance. Details of steps involved such as formation of Village Forest Committees, Joint Forest Participatory Management.

2. Forest Working Plan:

Forest planning, evaluation and monitoring tools and approaches for integrated planning multipurpose development of forest resources and forest industries development; working plans and working schemes, their role in nature conservation, bio-diversity and other dimensions; preparation and control. Divisional Working Plans, Annual Plan of Operations.

3. Forest Mensuration and Remote Sensing:

Methods of measuring - diameter, girth, height and volume of trees; form-factor; volume estimation of stand, current annual increment; mean annual increment. Sampling methods and sample plots. Yield calculation; yield and stand tables, forest cover monitoring through remote sensing; Geographic Information Systems for management and modeling.

4. Surveying and Forest Engineering:
Forestry - different methods of surveying, maps and map reading. Basic principles of forest engineering. Building materials and construction. Roads and Bridges; General principles, objects, types, simple design and construction of timber bridges.

Section B

1. Forest Ecology and Ethnobotany:
Forest ecology - Biotic and abiotic components, forest eco-systems; forest community concepts; vegetation concepts, ecological succession and climax, primary productivity, nutrient cycling and water relations; physiology in stress environments (drought, water logging salinity and alkalinity). Forest types in India, identification of species, composition and associations; dendrology, taxonomic classification, principles and establishment of herbaria and arboreta. Conservation of forest ecosystems. Clonal parks, Role of Ethnobotany in Indian Systems of Medicine; Ayurveda and Unani - Introduction, nomenclature, habitat, distribution and botanical features of medicinal and aromatic plants. Factors affecting action and toxicity of drug plants and their chemical constituents.

2. Forest Resources and Utilization: Environmentally sound forest harvesting practices; logging and extraction techniques and principles, transportation system, storage and sale; Non-Timber Forest Products (NTFPs) definition and scope; gums, resins, oleoresins, fibres, oil seeds nuts, rubber, canes, bamboos, medicinal plants, charcoal, lac and shellac, Katha and Bidi leaves, collection; processing and disposal. Need and importance of wood seasoning and preservation; general principles of seasoning, air and kiln seasoning, solar dehumidification, steam heated and electrical kilns. Composite wood; adhesives-manufacture, properties, uses, plywood manufacture-properties, uses, fibre boards-manufacture properties, uses; particle boards manufacture; properties uses. Present status of composite wood industry in India in future expansion plans. Pulp-paper and rayon; present position of supply of raw material to industry, wood substitution, utilization of plantation wood; problems and possibilities. Anatomical structure of wood, defects and abnormalities of wood, timber identification - general principles.

3. Forest Protection & Wildlife Biology:
Injuries to forest - abiotic and biotic, destructive agencies, insect-pests and disease, effects of air pollution on forests and forest die back. Susceptibility of forests to damage, nature of damage, cause, prevention, protective measures and benefits due to chemical and biological control. General forest protection against fire, equipment and methods, controlled use of fire, economic and environmental costs; timber salvage operations after natural disasters. Role of afforestation and forest regeneration in absorption of CO2. Rotational and controlled grazing, different methods of control against grazing and browsing animals; effect of wild animals on forest regeneration, human impacts; encroachment, poaching, grazing, live fencing, theft, shifting cultivation and control.

4. Forest Economics and Legislation:
Forest economics: fundamental principles, cost-benefit analyses; estimation of demand and supply; analysis of trends in the national and international market and changes in production and consumption patterns; assessment and projection of market structures; role of private sector and co-operatives; role of corporate financing. Socio-economic analyses of forest productivity and attitudes; valuation of forest goods and service. Legislation-History of forest development; Indian Forest Policy of 1894, 1952 and 1990. National Forest Policy, 1988 of People's involvement, Joint Forest Management, Involvement of women; Forestry Policies and issues related to land use, timber and non-timber products, sustainable forest management; industrialization policies; institutional and structural changes. Decentralization and Forestry Public Administration. Forest laws, necessity; general principles, Indian Forest Act 1927; Forest Conservation Act, 1980; Wildlife Protection Act 1972 and their amendments; Application of Indian Penal Code to Forestry. Scope and objectives of Forest inventory.

Section I

(i) General Geology

(ii) Geomorphology and Remote Sensing

(iii) Structural geology

Section-B
(iv) Paleontology

(v) Stratigraphy and Geology of India


Paper-II
Section-A
(i) Mineralogy
Classification of crystals into systems and classes of symmetry. International system of crystallographic notation. Use of projection diagrams to represent crystal symmetry. Crystal defects. Elements of X-ray crystallography.

(ii) Igneous and Metamorphic Petrology:

(iii) Sedimentology

Section-B
(iv) Economic Geology

(v) Mining Geology

(vi) Geochemistry and Environmental Geology
Pollution of ground and surface water, marine pollution Environment protection legislative measures in India.

Mathematics

Paper-I

Section-A

Linear Algebra
Vector, space, linear dependence and independence, subspaces, bases, dimensions. Finite dimensional vector spaces.
Matrices, Cayley-Hamilton theorem, Eigen values and Eigenvectors, matrix of linear transformation, row and column reduction, Echelon form, equivalence, congruence and similarity, reduction to canonical form, rank, orthogonal, symmetrical, skew symmetrical, unitary, hermitian, skew-hermitian forms their Eigen values. Orthogonal and unitary reduction of quadratic and hermitian forms, positive definite quadratic forms.

Calculus
Real numbers, limits, continuity, differentiability, mean-value theorems, Taylor's theorem with remainders, indeterminate forms, maxima and minima, asymptotes. Functions of several variables: continuity, differentiability, partial derivatives, maxima and minima, Lagrange's method of multipliers, Jacobian. Riemann’s definition of definite integrals, indefinite integrals, infinite and improper integrals, beta and gamma functions. Double and triple integrals (evaluation techniques only). Areas, surface and volumes, centre of gravity.

Analytic Geometry :
Cartesian and polar coordinates in two and three dimensions, second degree equations in two and three dimensions, reduction to canonical forms, straight lines, shortest distance between two skew lines, plane, sphere, cone, cylinder, paraboloid, ellipsoid, hyperboloid of one and two sheets and their properties.

Section-B

Ordinary Differential Equations :
Formulation of differential equations, order and degree, equations of first order and first degree, integrating factor, equations of first order but not of first degree, Clariaut's equation, singular solution. Higher order linear equations, with constant coefficients, complementary function and particular integral, general solution, Euler-Cauchy equation.
Second order linear equations with variable coefficients, determination of complete solution when one solution is known, method of variation of parameters.

Dynamics, Statics and Hydrostatics :
Degree of freedom and constraints, rectilinear motion, simple harmonic motion, motion in a plane, projectiles, constrained motion, work and energy, conservation of energy, motion under impulsive forces, Kepler's laws, orbits under central forces, motion of varying mass, motion under resistance.
Equilibrium of a system of particles, work and potential energy, friction, common catenary, principle of virtual work, stability of equilibrium, equilibrium of forces in three dimensions.
Pressure of heavy fluids, equilibrium of fluids under given system of forces Bernoulli's equation, centre of pressure, thrust on curved surfaces, equilibrium of floating bodies, stability of equilibrium, metacentre, pressure of gases.

Vector Analysis :
Scalar and vector fields, triple, products, differentiation of vector function of a scalar variable, gradient, divergence and curl in cartesian, cylindrical and spherical coordinates and their physical interpretations.
Higher order derivatives, vector identities and vector equations.
Application to Geometry: Curves in space, curvature and torsion. Serret-Frenet's formulae, Gauss and Stokes' theorems, Green's identities.

Paper-II

Section-A

Algebra:
Groups, subgroups, normal subgroups, homomorphism of groups quotient groups basic isomorphism theorems, Sylow's group, permutation groups, Cayley theorem. Rings and ideals, principal ideal domains, unique factorization domains and Euclidean domains. Field extensions, finite fields.

Real Analysis :
Real number system, ordered sets, bounds, ordered field, real number system as an ordered field with least upper bound property, Cauchy sequence, completeness, Continuity and uniform continuity of functions,
properties of continuous functions on compact sets. Riemann integral, improper integrals, absolute and conditional convergence of series of real and complex terms, rearrangement of series. Uniform convergence, continuity, differentiability and integrability for sequences and series of functions. Differentiation of functions of several variables, change in the order of partial derivatives, implicit function theorem, maxima and minima. Multiple integrals.

Complex Analysis:
Analytic function, Cauchy-Riemann equations, Cauchy’s theorem, Cauchy’s integral formula, power series, Taylor’s series, Laurent’s Series, Singularities, Cauchy’s residue theorem, contour integration. Conformal mapping, bilinear transformations.

Linear Programming:
Linear programming problems, basic solution, basic feasible solution and optimal solution, graphical method and Simplex method of solutions. Duality. Transportation and assignment problems. Travelling salesman problems.

Partial differential equations:
Curves and surfaces in three dimensions, formulation of partial differential equations, solutions of equations of type $dx/p=dy/q=dz/r$; orthogonal trajectories, Pfaffian differential equations; partial differential equations of the first order, solution by Cauchy’s method of characteristics; Charpit’s method of solutions, linear partial differential equations of the second order with constant coefficients, equations of vibrating string, heat equation, laplace equation.

Numerical Analysis and Computer programming:
Numerical methods: Solution of algebraic and transcendental equations of one variable by bisection, Regula-Falsi and Newton-Raphson methods, solution of system of linear equations by Gaussian elimination and Gauss-Jordan (direct) methods, Gauss-Seidel(iterative) method. Newton’s (Forward and backward) and Lagrange’s method of interpolation.

Numerical integration: Simpson’s one-third rule, trapezoidal rule, Gaussian quadrature formula.


Computer Programming:
Storage of numbers in Computers, bits, bytes and words, binary system. arithmetic and logical operations on numbers. Bitwise operations. AND, OR, XOR, NOT, and shift/rotate operators. Octal and Hexadecimal Systems. Conversion to and Form decimal Systems.
Representation of unsigned integers, signed integers and reals, double precision reals and long integers.
Algorithms and flow charts for solving numerical analysis problems.

Developing simple programs in Basic for problems involving techniques covered in the numerical analysis.

Mechanics and Fluid Dynamics:
Generalised coordinates, constraints, holonomic and non-holonomic, systems. D’Alembert’s principle and Lagrange ‘equations, Hamilton equations, moment of inertia, motion of rigid bodies in two dimensions.
Equation of continuity, Euler’s equation of motion for inviscid flow, stream-lines, path of a particle, potential flow, two-dimensional and axisymmetric motion, sources and sinks, vortex motion, flow past a cylinder and a sphere, method of images. Navier-Stokes equation for a viscous fluid.

Mechanical Engineering Paper I

1. Theory of Machines
Kinematic and dynamic analysis of planar mechanisms. Cams, Gears and gear trains, Flywheels, Governors, Balancing of rigid rotors, Balancing of single and multicylinder engines, Linear vibration analysis of mechanical systems (single degree and two degrees of freedom), Critical speeds and whirling of shafts, Automatic Controls, Belts and chain drives. Hydrodynamic bearings.

2. Mechanics of Solids:
Stress and strain in two dimensions. Principal stresses and strains, Mohr’s construction, linear elastic materials, isotropy and an isotropy, Stress-strain relations, uniaxial loading, thermal stresses. Beams: Bending moment and shear force diagrams, bending stresses and deflection of beams, Shear stress distribution. Torsion of shafts, helical springs. Combined stresses, Thick and thin walled pressure vessels. Struts and columns, Strain energy concepts and theories of failure. Rotation discs. Shrink fits.

3. Engineering Materials:

4. Manufacturing Science:

5. MANUFACTURING MANAGEMENT:
Production Planning and Control, Forecasting-Moving average, exponential smoothing, Operations shedding; assembly line balancing, Product development. Breakeven analysis, Capacity planning, PERT and CPM.

Value Engineering: Value analysis, for cost/value. Total quality management and forecasting techniques. Project management.

6. ELEMENTS OF COMPUTATION:

PAPER-II

1. THERMODYNAMICS:

2. I.C. Engines, Fuels and Combustion:
Choice of engine fuels, Octane and Cetane ratings. Alternate fuels Carburration and Fuel injection. Engine emissions and control. Solid, liquid and gaseous fuels. stoichiometric air requirements and excess air factor, fuel gas analysis. higher and lower calorific values and their measurements.

3. HEAT TRANSFER, REFRIGERATION AND AIR CONDITIONING:

4. TURBO-MACHINES AND POWER PLANTS:

Physics

Paper I

Section-A

1. Classical Mechanics
(a) Particle dynamics:
Centre of mass and laboratory coordinates conservation of linear and angular momentum. The rocket equation. Rutherford scattering. Galilean transformation, inertia and non-inertial frames. rotating frames, centrifugal and Coriolis forces, Foucault pendulum.
(b) System of particles:
Constraints, degrees of freedom, generalized coordinates and moments. Lagrange's equation and applications to linear harmonic oscillator, simple pendulum and central force problems. Cyclic coordinates, Hamiltonian Lagrange's equation from Hamilton's principle.
(c) Rigid body dynamics:
Eulerian angles, inertia tensor, principal moments of inertia. Euler's equation of motion of a rigid body, force-free motion of a rigid body, Gyroscope.

2. Special Relativity, Waves & Geometrical Optics
(a) Special Relativity:
Michelson-Morley experiment and its implications. Lorentz transformations-length contraction, time dilation, addition of velocities, aberration and Doppler effect, mass-energy relation. simple applications to a decay process. Minkowski diagram, four dimensional momentum vector. Covariance of equations of physics.
(b) Waves:
(c) Geometrical Optics:

3. Physical Optics:
(a) Interference:
Interference of light—Young's experiment, Newton's rings, interference by thin films, Michelson interferometer. Multiple beam interference and Fabry-Perot interferometer.

Holography and simple applications.

(b) Diffraction:
Fraunhofer diffraction—single slit, double slit, diffraction grating, resolving power. Fresnel diffraction—half-period zones and zones plates. Fresnel integrals. Application of Cornu's spiral to the analysis of diffraction at a straight edge and by a long narrow slit. Diffraction by a circular aperture and the Airy pattern.

(c) Polarisation and Modern Optics:

4. Electricity and Magnetism:
(a) Electrostatics and Magnetostatics:
(b) Current Electricity:

5. Electromagnetic Theory & Black Body Radiation:
(a) Electromagnetic Theory:
(b) Blackbody radiation:
Blackbody radiation ad Planck radiation law—Stefan-Boltzmann law, Wien displacement law and Rayleigh-Jeans law. Planck mass, Planck length, Planck time., Planck temperature and Planck energy.

6. Thermal and Statistical Physics:
(a) Thermodynamics:
(b) Statistical Physics:

Paper-II
Section-A

1. Quantum Mechanics I:

2. Quantum Mechanics II & Atomic Physics:
(a) Quantum Mechanics II:
(b) Atomic Physics:

3. Molecular Physics:
Section-B

4. Nuclear Physics:

5. Particle Physics & Solid State Physics:
(a) Particle Physics:

(b) Solid State Physics:

6. Electronics:

Statistics

Paper-I

Probability:
Sample space and events, probability measure and probability space, random variable as a measurable function, distribution function of a random variable, discrete and continuous-type random variable probability mass function, probability density function, vector-valued random variable, marginal and conditional distributions, stochastic independence of events and of random variables, expectation and moments of a random variable, conditional expectation, convergence of a sequence of random variable in distribution, in probability, in p-th mean and almost everywhere, their criteria and inter-relations, Borel-Cantelli lemma, Chebyshev’s and Khinchine’s weak laws of large numbers, strong law of large numbers and Kolmogorov’s theorems, Glivenko-Cantelli theorem, probability generating function, characteristic function, inversion theorem, Laplace transform, related uniqueness and continuity theorems, determination of distribution by its moments. Linderberg and Levy forms of central limit theorem, standard discrete and continuous probability distributions, their inter-relations and limiting cases, simple properties of finite Markov chains.

Statistical Inference:
Consistency, unbiasedness, efficiency, sufficiency, minimal sufficiency, complete-ness, ancillary statistic, factorization theorem, exponential family of distribution and its properties, uniformly minimum variance unbiased (UMVU) estimation, Rao-Blackwell and Lehmann-Scheffe theorems, Cramer-Rao inequality for single and several-parameter family of distributions, minimum variance bound estimator and its properties, modifications and extensions of Cramer-Rao inequality, Chapman-Robbins inequality, Bhattacharyya's bounds, estimation by methods of moments, maximum likelihood, least squares, minimum chi-square and modified minimum chi-square, properties of maximum likelihood and other estimators, idea of asymptotic efficiency, idea of prior and posterior distributions, Bayes’ estimators.

Non-randomised and randomised tests, critical function, MP tests, Neyman-Pearson lemma, UMP tests, monotone likelihood ratio, generalised Neyman-Pearson lemma, similar and unbiased tests, UMPU tests for single and several-parameter families of distributions, likelihood rotates and its large sample properties, chi-square goodness of fit test and its asymptotic distribution.

Confidence bounds and its relation with tests, uniformly most accurate (UMA) and UMA unbiased confidence bounds.


Wald’s SPRT and its properties, OC and ASN functions, Wald’s fundamental identity, sequential estimation.

Linear Inference and Multivariate Analysis:
Linear statistical models, theory of least squares and analysis of variance, Gauss-Markoff theorem, normal equations, least squares estimates and their precision, test of significance and interval estimates based on least squares theory in one-way, two-way and three-way classified data, regression analysis, linear regression, curvilinear regression and orthogonal polynomials, multiple regression, multiple and partial correlations, regression diagnostics and sensitivity analysis, calibration problems, estimation of variance and covariance components, MINQUE theory, multivariate normal distribution, Mahalanobis D2 and Hotelling’s T2 statistics and their applications and properties, discriminant analysis, canonical correlations, one-way MANOVA, principal component analysis, elements of factor analysis.
Sampling Theory and Design of Experiments:
An outline of fixed-population and super-population approaches, distinctive features of finite population sampling, probability sampling designs, simple random sampling with and without replacement, stratified random sampling, systematic sampling and its efficacy for structural populations, cluster sampling, two-stage and multi-stage sampling, ratio and regression, methods of estimation involving one or more auxiliary variables, two-phase sampling, probability proportional to size sampling with and without replacement, the Hansen-Hurwitz and the Horvitz-Thompson estimators, non-negative variance estimation with reference to the Horvitz-Thompson estimator, non-sampling errors, Warner’s randomized response technique for sensitive characteristics.

Fixed effects model (two-way classification) random and mixed effects models (two-way classification per cell), CRD, RBD, LSD and their analyses, incomplete block designs, concepts of orthogonality and balance, BIBD, missing plot technique, factorial designs : 2^n, 3^2 and 3^3, confounding in factorial experiments, split-plot and simple lattice designs.

I. Industrial Statistics
Process and product control, general theory of control charts, different types of control charts for variables and attributes, X, R, s, p, np and c charts, cumulative sum chart, V-mask, single, double, multiple and sequential sampling plans for attributes, OC, ASN, AOQ and ATI curves, concepts of producer’s and consumer’s risks, AQL, LTPD and AOQL, sampling plans for variables, use of Dodge-Romig and Military Standard tables.

Concepts of reliability, maintainability and availability, reliability of series and parallel systems and other simple configurations, renewal density and renewal function, survival models (exponential), Weibull, lognormal, Rayleigh, and bath-tub), different types of redundancy and use of redundancy in reliability improvement, problems in life-testing, censored and truncated experiments for exponential models.

II. Optimization Techniques:
Different, types of models in Operational Research, their construction and general methods of solution, simulation and Monte-Carlo methods, the structure and formulation of linear programming (LP) problem, simple LP model and its graphical solution, the simplex procedure, the two-phase method and the M-technique with artificial variables, the duality theory of LP and its economic interpretation, sensitivity analysis, transportation and assignment problems, rectangular games, two-person zero-sum games, methods of solution (graphical and algebraic).

Replacement of failing or deteriorating items, group and individual replacement policies, concept of scientific inventory management and analytical structure of inventory problems, simple models with deterministic and stochastic demand with and without lead time, storage models with particular reference to dam type.

Homogeneous discrete-time Markov chains, transition probability matrix, classification of states and ergodic theorems, homogeneous continuous-time Markov chains, Poisson process, elements of queueing theory, M/M/1, M/M/K, G/M/1 and M/G/1 queues.

Solution of statistical problems on computers using well known statistical software packages like SPSS.

III. Quantitative Economics and Official Statistics:
Determination of trend, seasonal and cyclical components, Box-Jenkins method, tests for stationery of series, ARIMA models and determination of orders of autoregressive and moving average components, forecasting. Commonly used index numbers-Laspeyre’s, Paashe’s and Fisher’s ideal index numbers, chain-base index number uses and limitations of index numbers, index number of wholesale prices, consumer price index number, index numbers of agricultural and industrial production, tests, for index numbers like proportionality test, time-reversal test, factor-reversal test, circular test and dimensional invariance test.

General linear model, ordinary least squares and generalised least squares methods of estimation, problem of multicollinearity, consequences and solutions of multicollinearity, autocorrelation and its consequences, heteroscedasticity of disturbances and its testing, test for independence of disturbances, Zellner’s seemingly unrelated regression equation model and its estimation, concept of structure and model for simultaneous equations, problem of identification-rank and order conditions of identifiability, two-stage least squares method of estimation.

Present official statistical system in India relating to population, agriculture, industrial production, trade and prices, methods of collection of official statistics, their reliability and limitation and the principal publications containing such statistics, various official agencies responsible for data collection and their main functions.

IV. Demography and Psychometry:
Demographic data from census, registration, NSS and other surveys, and their limitation and uses, definition, construction and uses of vital rates and ratios, measures of fertility, reproduction rates, morbidity rate, standardized death rate, complete and abridged life tables, construction of life tables from vital statistics and census returns, uses of life tables, logistic and other population growth curves, fitting a logistic curve, population projection, stable population theory, uses of stable population and quasi-stable population techniques in estimation of demographic parameters, morbidity and its measurement, standard classification by cause of death, health surveys and use of hospital statistics.

Methods of standardisation of scales and tests, Z-scores, standard scores, scores, percentile scores, intelligence quotient and its measurement and uses, validity of test scores and its determination, use of factor analysis and path analysis in psychometry.
1. Non-chordata and chordata:
(a) Classification and relationship of various phyla up to sub-classes; Acoelomata and Coelomata; Protostomes and Deuterostomes, Bilateralia and Radiata; Status of Protista, Parazoa, Onychophora and Hemichordata; Symmetry.
(b) Protozoa: Locomotion, nutrition, reproduction; evolution of sex; General features and life history of Paramaecium, Monocystis, Plasmodium, and Leishmania.
(c) Porifera: Skeleton, canal system and reproduction.
(d) Coelenterata: Polymorphism, defensive structures and their mechanism; coral reefs and their formation; metagenesis; general features and life history of Obelia and Aurelia.
(e) Platyhelminthes: Parasitic adaptation; general features and life history of Fasciola and Taenia and their relation to man.
(f) Nemathelminthes: General features, life history and parasitic adaptation of Ascaris; nemathelminths in relation to man.
(g) Annelida: Coelom and metamerism; modes of life in polychaetes; general features and life history of nereis (Neanthes), earthworm (Pheretima) and leach (Hirudinaria).
(h) Arthropoda: Larval forms and parasitism in Crustacea; vision and respiration in arthropods (prawn, cockroach and scorpion); modification of mouth parts in insects (cockroach, mosquito, housefly, honey bee and butterfly); metamorphosis in insects and its hormonal regulation; social organization in insects (termites and honey bees).
(i) Mollusca: Feeding, respiration, locomotion, shell diversity; general features and life history of Lamellidens, Pla and Sepia, torsion and detorsion in gastropods.
(j) Echinodermata: Feeding, respiration, locomotion larval forms; general features and life history of Asterias.
(k) Protochordata: Origin of chordates; general features and life history of Branchiostoma and Herdmania.
(l) Pisces: Scales, respiration, locomotion, migration.
(m) Amphibia: Origin of tetrapods; parental care, paedomorphosis.
(n) Reptilia: Origin of reptiles; skull types; status of Sphenodon and crocodiles.
(o) Mammalia: Origin of mammals; dentition; general features of egg laying mammals, pouched-mammals, aquatic mammals and primates; endocrine glands and other hormone producing structures (pituitary, thyroid, parathyroid, adrenal, pancreas, gonads) and their interrelationships.
(q) Comparative functional anatomy of various systems of vertebrates (integument and its derivatives, endoskeleton, locomotory organs, digestive system, respiratory system, circulatory system including heart and aortic arches; urinogenital system, brain and sense organs (eye and ear).

Section-B

1. Ecology:
(a) Biosphere: Biogeochemical cycles, green-houses effect, ozone layer and its impact; ecological succession, biomes and ecotones.
(b) Population, characteristics, population dynamics, population stabilization.
(c) Conservation of natural resources- mineral mining, fisheries, aquaculture; forestry; grassland; wildlife (Project Tiger); sustainable production in agriculture integrated pest management.
(d) Environmental biodegradation; pollution and its impact on biosphere and its prevention.

II. Ethology:
(a) Behaviour: Sensory filtering, responsiveness, sign stimuli, learning, instinct, habituation, conditioning, imprinting.
(b) Role of hormones in drive; role of pheromones in alarm spreading; crypsis, predator detection, predator tactics, social behaviour in insects and primates; courtship (Drosophila, 3-spine stickleback and birds).
(c) Orientation, navigation, homing; biological rhythms; biological clock, tidal, seasonal and circadian rhythms.
(d) Methods of studying animal behaviour.

III. Economic Zoology:
(a) Apiculture, sericulture, lac culture, carp culture, pearl culture, prawn culture.
(b) Major infectious and communicable diseases (small pox, plague, malaria, tuberculosis, cholera and AIDS) their vectors, pathogens and prevention.
(c) Cattle and livestock diseases, their pathogens (helminthes) and vectors (ticks, mites, Tabanus, Stomoxys).
(d) Pests of sugar cane (Pyrrila perpusiella), oil seed (Achaea janata) and rice (Sitophilus oryzae).

IV. Biostatistics:
(a) Designing of experiments; null hypothesis; correlation, regression, distribution and measure of central tendency, chi square, student t-test, F-test (one-way & two-way F-test).

V. Instrumental methods:
(a) Spectrophotometry, flame photometry, Geiger-Muller counter, scintillation counting.
(b) Electron microscopy (TEM, SEM).
Section-A

I. Cell Biology:
(a) Structure and function of cell and its organelles (nucleus, plasma membrane, mitochondria, Golgi bodies, endoplasmic reticulum, ribosome's and lysosomes), cell division (mitosis and meiosis), mitotic spindle and mitotic apparatus, chromosome movement.
(b) Watson-Crick model of DNA, replication of DNA, protein synthesis, transcription and transcription factors.

II. Genetics
(a) Gene structure and functions; genetic code.
(b) Sex chromosomes and sex determination in Drosophila, nematodes and man.
(c) Mendel's laws of inheritance, recombination, linkage, linkage maps, multiple alleles, citron concept; genetics of blood groups.
(d) Mutations and mutagenesis: radiation and chemical.
(e) Cloning technology, plasmids and cosmids as vectors, transgenic, transposons, DNA sequence cloning and whole animal cloning (Principles and methodology).
(f) Regulation and gene expression in pro- and eukaryotes.
(g) Signal transduction; pedigree analysis; congenital diseases in man.
(h) Human genome mapping; DNA finger-printing.

III. Evolution
(a) Origin of life
(b) Natural selection, role of mutation in evolution, mimicry, variation, isolation, speciation.
(c) Fossils and fossilization; evolution of horse, elephant and man.
(d) Hardy-Weinberg Law, causes of change in gene frequency.
(e) Continental drift and distribution of animals.

IV. Systematics
(a) Zoological nomenclature; international code; cladistics.

Section-B

I. Biochemistry
(a) Structure and role of carbohydrates, fats, lipids, proteins, amino acids, nucleic acids; saturated and unsaturated fatty acids, cholesterol.
(b) Glycolysis and Krebs cycle, oxidation and reduction, oxidative phosphorylation; energy conservation and release, ATP, cyclic AMP, its structure and role.
(c) Hormone classification (steroid and peptide hormones), biosynthesis and function.
(d) Enzymes: types and mechanisms of action; immunoglobulin and immunity; vitamins and coenzymes.
(e) Bioenergetics.

II Physiology (with special reference to mammals)
(a) Composition and constituents of blood; blood groups and Rh factor in man; coagulation, factors and mechanism of coagulation; acid-base balance, thermo regulation.
(b) Oxygen and carbon dioxide transport; haemoglobin: constituents and role in regulation.
(c) Nutritive requirements; role of salivary glands, liver, pancreas and intestinal glands in digestion and absorption.
(d) Excretory products; nephron and regulation of urine formation; osmoregulation.
(e) Types of muscles, mechanism of contraction of skeletal muscles.
(f) Neuron, nerve impulse, its conduction and synaptic transmission; neurotransmitters.
(g) Vision, hearing and olfaction in man.
(h) Mechanism of hormone action.
(i) Physiology of reproduction, role of hormones and pheromones.

III. Developmental Biology
(a) Differentiation from gamete to neurula stage; dedifferentiation; metaplasia, induction, morphogenesis and morphogen; fate maps of gastrulae in frog and chick; organogenesis of eye and heart, placentation in mammals.
(b) Role of cytoplasm in and genetic control of development; cell lineage; causation of metamorphosis in frog and insects; paedogenesis and neoteny; growth, degrowth and cell death; ageing; blastogenesis; regeneration; teratogenesis; neoplasia.
(c) Invasiveness of placenta; in vitro fertilization; embryo transfer, cloning.
(d) Baer’s law; evo-devo concept.

APPENDIX - II

INSTRUCTIONS TO THE CANDIDATES FOR FILLING ONLINE APPLICATIONS
Candidates are required to apply Online using the website www.upsconline.nic.in.
Salient features of the system of Online Application Form are given hereunder:
• Detailed instructions for filling up Online applications are available on the above-mentioned website.
• Candidates will be required to complete the Online Application Form containing two stages viz. Part-I and Part-II as per the instructions available in the above-mentioned site through drop-down menus.
The candidates are required to pay a fee of Rs.100/- (Rupees One Hundred only) [excepting SC/ST/ Female/Physically Handicapped candidates who are exempted from payment of fee] either by depositing the money in any branch of SBI by cash, or by using net banking facility of State Bank of India/State Bank of Bikaner & Jaipur/State Bank of Hyderabad/State Bank of Mysore / State Bank of Patiala/State Bank of Travancore or by using any Visa/Master Credit/ Debit Card.

Before start filling up of Online Application, a candidate must have his/her photograph and signature duly scanned in the .jpg format in such a manner that each file should not exceed 40 KB and must not be less than 3 KB in size for the photograph and 1 KB for the signature.

The Online applications(Part I and II) can be filled from 22nd February, 2017 to 17th March, 2017 till 18.00 Hours.

Applicants should avoid submitting multiple applications. However, if due to any unavoidable circumstances, any applicant submits multiple applications then he/she must ensure that the applications with higher RID is complete in all respects.

In case of multiple applications, the applications with higher RID shall be entertained by the Commission and fee paid against one RID shall not be adjusted against any other RID.

The applicants must ensure that while filling their Application Form, they are providing their valid and active E-Mail IDs as the Commission may use electronic mode of communication while contacting them at different stages of examination process.

The applicants are advised to check their emails at regular intervals and ensure that the email address ending with @nic.in are directed to their inbox folder and not to the SPAM folder or any other folder.

Candidates are strongly advised to apply online well in time without waiting for the last date for submission of Online Applications.

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Appendix III
Special Instruction to candidates for objective type tests

1. Articles permitted inside Examination Hall
   - Clip board or hard board (on which nothing is written), a good quality black ball pen for making responses on the Answer Sheet. Answer Sheet and sheet for rough work will be supplied by the invigilator.
   - Mobile phones, bluetooth or any other communication devices are not allowed inside the premises where the examination is being conducted. Any infringement of these instructions shall entail disciplinary action including ban from future examinations. Candidates are advised in their own interest not to bring any of the banned items including mobile phones, to the venue of the examination, as arrangements for safekeeping cannot be assured.

2. Articles not permitted inside Examination Hall
   - Do not bring into the Examination Hall any article other than those specified above e.g. books, notes, loose sheets, electronic or any other type of calculators, mathematical and drawing instruments, Log Tables, stencils of maps, slide rules, Test Booklets, rough sheets pertaining to earlier session(s), etc.

3. Penalty for wrong Answers (in Objective Type Papers)
   - THERE WILL BE PENALTY (NEGATIVE MARKING) FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.
     (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, one third (0.33) of the marks assigned to that question will be deducted as penalty.
     (ii) If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct and there will be same penalty as above for that question.
     (iii) If a question is left blank i.e. no answer is given by the candidate, there will be no penalty for that question.

4. Unfair means strictly prohibited
   - No candidates shall copy from the papers of any other candidate nor permit his papers to be copied nor give nor attempt to give not obtain nor attempt to obtain irregular assistance of any description.

5. Conduct in Examination Hall
   - No candidates should misbehave in any manner or create disorderly scene in the Examination Hall or harass the staff employed by the Commission for the conduct of the examination. Any such misconduct will be severely penalised.

5. Answer Sheet Particulars
   (i) Write in black ball pen your Centre and subject followed by Test Booklet series (in bracket), subject code and roll number at the appropriate space provided on the Answer Sheet at the top. Also encode your booklet series (A, B, C or D as the case may be) subject code and roll number with black ball pen in the circles provided for the purpose in the Answer Sheet. The guidelines for writing the above particulars and encoding the above particulars are given in Annexure. In case the booklet series is not printed on the Test
Booklet or Answer Sheet is unnumbered, please report immediately to the invigilator and get the Test Booklet/Answer Sheet replaced.

(ii) Candidates should note that any omission/mistake/discrepancy in encoding/filling of details in the OMR answer sheet, especially with regard to Roll Number and Test Booklet Series Code, will render the answer sheet liable for rejection.

(iii) Immediately after commencement of the examination please check that the Test Booklet supplied to you does not have any unprinted or torn or missing pages or items etc. If so, get it replaced by a complete Test Booklet of the same series and subject.

6. Do not write your name or anything other than the specific items of information asked for, on the Answer Sheet/Test Booklet/sheet for rough work.

8. Do not fold or mutilate or damage or put any extraneous marking in the Answer Sheet. Do not write anything on the reverse of the Answer Sheet.

9. Since the Answer Sheets will be evaluated on computerised machines, candidates should exercise due care in handling and filling up the Answer Sheets. They should use black ball pen only to darken the circles. For writing in boxes, they should use black ball pen. Since the entries made by the candidates by darkening the circles will be taken into account while evaluating the Answer Sheet on computerised machines, they should make these entries very carefully and accurately. The candidate must mark responses in the Answer Sheet with good quality black ball pen.

10. Method of marking answers
In the "OBJECTIVE TYPE" of examination you do not write the answers. For each question (hereinafter referred to as "Item") several suggested answers (hereinafter referred to as "Responses") are given. You have to choose one response to each item. The question paper will be in the Form of TEST BOOKLET. The booklet will contain item bearing numbers 1, 2, 3 etc. Under each item, Responses marked (a), (b), (c), (d) will be given. Your task will be to choose the correct response. If you think there is more than one correct response, then choose which you consider the best response.
In any case, for each item you are to select only one response. If you select more than one response, your response will be considered wrong. In the Answer Sheet, Serial Nos. from 1 to 160 are printed. Against each numbers, there are circles marked (a), (b), (c), (d). After you have read each item in the Test Booklet and decided which one of the given responses is correct or the best, you have to mark your response by completely blackening to indicate your response.
Ink pen or pencil should not be used for blackening the circle on the Answer Sheet.
For example, if the correct answer to item 1 is (b), then the circle containing the letter (b) is to be completely blackened with black ball pen as shown below:

Example: (a) • (c) (d)

11. Entries in Scannable Attendance List
Candidates are required to fill in the relevant particulars with black ball pen only against their columns in the Scannable Attendance List as given below:

i) Blacken the circle (P) under the column (Present/Absent)
ii) Blacken the relevant circle for Test Booklet Series
iii) Write Test Booklet Serial No.
iv) Write the Answer Sheet serial No. and also blacken the corresponding circles below
v) Append signature in the relevant column

12. Please read and abide by the instructions on the cover of Test Booklet. If any candidate indulges in disorderly or improper conduct, he will render himself liable for disciplinary action and/or imposition of a penalty as the Commission may deem fit.

13. The candidates are not allowed to leave the Examination Hall before the expiry of prescribed time period of the examination.

Annexure

How to fill in the Answer Sheet of objective type tests in the Examination Hall
Please follow these instructions very carefully. You may note that since the Answer Sheets are to be evaluated on machine any violation of these instructions may result in reduction of your score for which you would yourself be responsible.
Before you mark your responses on the Answer Sheet, you will have to fill in various particulars in it.
As soon as the candidate receives the Answer Sheet, he/she should check that it is numbered at the bottom.
If it is found unnumbered he/she should at once get it replaced by a numbered one!

You will see from the Answer Sheet that you will have to fill in the top line, which reads thus:

<table>
<thead>
<tr>
<th>केन्द्र</th>
<th>विषय</th>
<th>विषय कोड</th>
<th>अन्तर्गतक</th>
<th>Roll Number</th>
</tr>
</thead>
</table>

Centre | Subject | S. Code | Roll Number

If you are, say, appearing for the examination in Delhi Centre for the General Studies Paper and your Roll No. is 081276 and your Test Booklet series is 'A', you should fill in thus, using ball pen.

*This is just illustrative and may not be relevant to the Examination concerned.

<table>
<thead>
<tr>
<th>केन्द्र</th>
<th>विषय</th>
<th>विषय कोड</th>
<th>अन्तर्गतक</th>
<th>Roll Number</th>
</tr>
</thead>
</table>

Centre | Subject | S. Code | Roll Number

Delhi | General Studies | 9 9 | 0 8 1 2 7 6
You should write with black ball pen the name of the centre and subject in English or Hindi. The test Booklet Series is indicated by Alphabets A, B, C or D at the top right hand corner of the Booklet. Write your Roll Numbers exactly as it is in your e-Admit Card in the boxes provided for this purpose. Do not omit any zero(s) which may be there.

The next step is to find out the appropriate subject code from the Time Table. Now encode the Test Booklet Series, Subject Code and the Roll Number in the circles provided for this purpose. Do the encoding with black pen. The name of the Centre need not be encoded.

Writing and encoding of Test Booklet Series is to be done after receiving the Test Booklet and confirming the Booklet Series from the same.

For General Ability subject paper of 'A' Test Booklet Series you have to encode the subject code, which is 99. Do it thus.

<table>
<thead>
<tr>
<th>Booklet Series (A)</th>
<th>Subject Code 9 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0 0</td>
</tr>
<tr>
<td>B</td>
<td>1 1</td>
</tr>
<tr>
<td>C</td>
<td>2 2</td>
</tr>
<tr>
<td>D</td>
<td>3 3</td>
</tr>
</tbody>
</table>

All that is required is to blacken completely the circle marked ‘A’ below the Booklet Series and below the subject code blacken completely the Circles for ‘9’ (in the first vertical column) and ‘9’ (in the second vertical column). You should then encode the Roll No. 081276. Do it thus similarly.

Roll Numbers

0 8 1 2 7 6

Important: Please ensure that you have have carefully encoded your subject, Test Booklet Series and Roll Number.

* This is just illustrative and may not be relevant to your Examination.