



# PUBLIC SERVICE COMMISSION, UTTAR PRADESH

Advertisement No.  
A-7/E-1/2013  
Date 20-12-2013

## Asstt. Conservator of Forest Examination-2013

Last Date for Receipt of Examination Fees in the Bank : 16<sup>th</sup> January, 2014.

Last Date for Receipt of Applications : 20<sup>th</sup> January, 2014.

**"SPECIAL NOTICE :-** Applications will be accepted only when fee is deposited in the Bank upto prescribed last date for fee deposition. If the fee is deposited in bank after prescribed last date for fee deposition, the candidature of the candidate will be rejected and application will not be accepted. Once fee deposited in the bank will not be refunded to the candidate in any condition. It will be responsibility of the candidate to deposit fee in the bank upto prescribed last date for fee deposition and submit the application upto prescribed last date for submission of applications."

**Candidates after submitting their applications through On-Line shall send photocopies of their all academic/required documents regarding their claims alongwith print out of On-Line application forms by means of Personally/Speed Post/Registered Post in any working days latest by dated 30<sup>th</sup> January, 2014 till 5.00 O' Clock and must ensure for submission in the office of the Commission. For this purpose the candidates are advised to download address slip from Commission's website and to paste it on the envelope containing documents. Till the aforesaid last date if the required relevant documents/records are not received in the Office of the Commission, in the aforesaid condition, the On-Line Application will be rejected. Important Notice- The candidates can send/submit their all academic/required documents as claimed in the On-Line Applications in the Office of the Commission in any working day latest by 30<sup>th</sup> January, 2014 till 5.00 O' Clock following the aforesaid process after applying the On-Line Application.**

### NECESSARY INFORMATION FOR APPLICANTS FILLING THEIR APPLICATION THROUGH ON-LINE

This advertisement is also available on the Commission's website <http://uppsc.up.nic.in>. The On-line application system is applicable for applying against this advertisement. Applications sent by any other mode shall not be entertained. Candidates are advised to apply On-line only. In connection with On-line application, candidates are advised to go through thoroughly the instructions given as under and apply accordingly.

1. When the candidate clicks "ALL NOTIFICATION/ADVERTISEMENT DETAILS" on the Commission's website <http://uppsc.up.nic.in> the On-line advertisement, only shall be available. "On-line advertisement" shall be in 3 stages given as below :

1. User instruction
2. View Advertisement
3. Apply

A list of all the advertisement will be displayed in which "On-line System" is applicable. The Instructions for filling "On-line form" have been given in User Instruction. The Candidates desirous to see the advertisement will have to click before 'View Advertisement' to which they are desirous to see. The full advertisement will be displayed. Click on "Apply" for On-line Application.

**On-line application will be completed in three stages :**

**First Stage:-** Basic Registration form (Appendix-2) will be displayed on clicking the 'Candidate Registration' respective to Examination in Appendix-1, in which there shall be type of Recruitment (Select type of Rectt.) General, after filling the form on clicking the 'submit' button the registration of First stage shall be over. Thereafter 'Candidate Registration Acknowledgment' (Appendix-3) shall be displayed which can be printed by Clicking the 'Print' Button.

**Second Stage:-** There shall be two options for depositing the fees which are E-challan and I-collect, which can be deposited in State Bank of India or Punjab National Bank. The candidates having Net Banking facility in any of these two banks may deposit the fees through I-collect. After taking the option of E-Challan or I-Collect Examination fees payment details will be displayed which is on Appendix-4. On selecting the bank to deposit the fees through E-Challan, the E-challan of concerned bank SBI- (Appendix-5) and PNB (Appendix-6) will be displayed in which there shall be Candidate Registration No., Name, Date of Birth and Fee Amount. The candidates will have to go with E-Challan (in the Bank which is opted by the Candidates themselves) to any branch of the Bank and deposit the fees and take one copy of E-Challan and keep with them safely. On the copy of the E-Challan given by the Bank transaction ID/Journal No. and date shall be mentioned which shall be used at the time of filling the form at third stage.

**Third stage :-** After depositing the fee in the Bank, the candidates two day after on the working day (after 2.00 pm) shall enter information On-line in the format, available on Commission's website by clicking "Submit Application Form". The photo and signature, duly scanned shall be uploaded also. The specimen of the same is given at Appendix-7. The candidate should scan his photograph and signature in the prescribed size (the size will be mentioned at the specified spot in the On-line application). This should also be kept in notice that the photo must be latest passport size. In case the photo and signature, scanned in the prescribed size, are not uploaded, then the On-line system will not accept it. The procedure related to scanning of the photo and signature is laid down in the Appendix-7A. After filling in all entries in the format, the candidates may click "View application form" to see for themselves that all entries and informations are correctly entered and after satisfying themselves should click "Submit" to forward the same to the Commission. It is essential that the candidate should fill all informations On-line correctly according to the instructions given and click the 'Submit' button by the last date prescribed for submission of the application form. If the candidate does not click the "Submit" button, the application shall not be completed finally and the candidate shall be accountable for this. After clicking the 'Submit' button, the candidate may take a print-out of the application (Appendix-7B) to preserve it with them. In the event of any discrepancies, the candidate will be required to submit the said print-out in the office of the Commission, otherwise his/her request shall not be entertained.

2. The Application once submitted, will not be allowed to be modified.

3. **Application Fee :** After filling in the 'Candidate Registration' format of the On-line application, the candidate shall procure the print-out of the E-challan in duplicate. The E-Challan will be used to deposit the fee in any of the branches of State Bank of India or Punjab National Bank by the candidate according to his category. The fee will not be allowed to be deposited by any other mode except E-Challan/I-collect. The above fee, for Examination according to the category, is as under:-

1. Unreserved (General) - Exam fee Rs. 200/- + On-line processing fee Rs. 15/-  
Total = Rs. 215/-
2. Other Backward Class - Exam fee Rs. 200/- + On-line processing fee Rs. 15/-  
Total = Rs. 215/-
3. Scheduled Caste - Exam fee Rs. 80/- + On-line processing fee Rs. 15/- Total = Rs. 95/-
4. Scheduled Tribe - Exam fee Rs. 80/- + On-line processing fee Rs. 15/- Total = Rs. 95/-
5. Handicapped - Exam fee NIL + On-line processing fee Rs. 15/- Total = Rs. 15/-
6. Dependants of the Freedom Fighters - According to the original category mentioned from Sl. Nos. 1 to 4.
7. Ex-Servicemen - According to the original category mentioned from Sl. Nos. 1 to 4.
8. Women - According to the original category mentioned from Sl. Nos. 1 to 4.

4. If the claims of the candidates given in their applications are not found true, they can be debarred not only from the examination in question but from all the future examinations and

selections made by the Commission also including other appropriate penalties.

5. If the candidates want some correction or change in their submitted applications, they can submit another fresh complete applications with desired corrections along with prescribed fee within the last notified dates of the advertisement. The application fee deposited with the prior application will neither be returned nor adjusted in any condition. In the aforesaid condition, the application form of that Registration No. on which admit card candidate will appear in the examination, will be treated as final. Rest applications will be treated as cancelled.

6. The U.P. Public Service Commission shall hold a Examination at various Centres of the Districts mentioned in Appendix-8 of this advertisement. The selection will be made on the basis of written examination and interview. The marks of interview will be added to the marks obtained in the written examination of the candidates and their place will depend on the aggregate of both. So the candidates who qualify in the written exam. shall have to appear compulsorily in interview. Only such candidates will be called for interview who are declared successful on the basis of above written Examination. The date and venue of examination decided by the Commission will be intimated to the candidates by means of their e-Admission certificates. No. of Districts/Centres may increase or decrease according to final No. of applications received.

7. **No. of Vacancies :** Vacancies are as under :-

Total Vacancies	Unreserved	SC	ST	OBC
31	07	10	01	13

**Pay Scale :** Rs. 15600-Rs. 39100/- (Grade Pay Rs. 5400/-) Post Gazetted. **Note:-** No. of vacancies may increase or decrease.

8. **Reservation :** The reservation for Scheduled Castes of U.P./Scheduled Tribes of U.P./Other Backward Class candidates of U.P. shall be admissible in accordance with the provisions of relevant Govt. Rules. Accordingly, reservation for category under horizontal as Dependents of Freedom Fighters of U.P. and Women candidates of U.P. shall be admissible on settlement of vacancies. Reservation for PH of U.P. (only for O.A. and P.D. as earmarked by the Govt.) will be admissible only on settlement of vacancies.

**Note :** (1) The Candidates claiming the benefit of reservation/age relaxation must obtain in support of their category a certificate issued by competent authority on the proforma available on the Website & Appendix 8-A of this detailed advertisement and shall submit the same to the Commission when asked for. (2) All Reserved candidates of U.P. must mention their Category/Sub Category in the Application Form. (3) Candidates claiming reservation/age relaxation in more than one category will be entitled to only one concession whichever is more beneficial to them. (4) The Scheduled Caste, Scheduled Tribes, Other Backward Class and Dependents of Freedom Fighter, PH and women candidates who are not the permanent residents of U.P. shall not be given the benefit of reservation. Such candidates shall be treated as the candidates of the General Category. In case of women candidates the certificate issued from father side only be treated valid.

9. **Conditions of Eligibility (For age relaxation only) : (I) Eligibility in case of Emergency Commissioned/Short Service Commissioned Officers:** In accordance with the provision of the G.O. No. 22/10/1976-Karmik-2-85, dated 30-1-1985 Emergency Commissioned/Short Service Commissioned Officers who have not been released from Army but whose period of Army service has been extended for rehabilitation may also apply for this examination on the following conditions: (A) Such applicants have to obtain a certificate of the competent authority of Army, Navy, Air Force to the effect that their period of Service has been extended for rehabilitation and no disciplinary action is pending against them. (B) Such applicants will have to submit with the application forms a written undertaking that in case they are selected for the post they will get themselves released immediately from the Army Service. The above facilities will not be admissible to Emergency/ Short Service Commissioned Officers, if (a) he gets permanent Commission in the Army, (b) he has been released from Army on tendering registration, (c) he has been released from the Army on grounds of misconduct or physical disability.

10. **MARITAL STATUS :** Male candidates who are married and have more than one wife living and female candidates who have married a person already having a wife, shall not be eligible unless the Hon. Governor has granted exemption from this condition.

11. **EDUCATIONAL QUALIFICATION :** A Bachelors degree with at least one of the subject namely Botany, Zoology, Chemistry, Physics, Mathematics, Geology, Forestry and Statistics or a Bachelors degree in Agriculture or Bachelors degree in Engineering from a University established by Law in India or a Foreign University approved by the Central Government from time to time, or a qualification recognised by the Government as equivalent thereto.

**PREFERENTIAL QUALIFICATION :** A candidate who has (1) served in the Territorial Army for a minimum period of two years, or (2) obtained a "B" certificate of N.C.C. shall other things being equal, be given preference in the matter of direct recruitment.

**MINIMUM PHYSICAL STANDARD : (1)** No candidate for direct recruitment shall be appointed to the service unless he possesses the minimum standard for height and chest grith as specified below:-

Sex	Height	Chest grith (Fully expanded)	Expansion
Male	163 cms.	84 cms.	5 cms.
Female	150 cms.	79 cms.	5 cms.

Provided that the minimum height standard in case of candidates belonging to Scheduled Tribes and to races such as Gorkhas, Nepales, Assamese, Meghalayan Tribal, Laddakhese, Sikkimese, Bhutanese, Garhwales, Kumaunies, Nagas and Arunachal Pradesh candidates, shall be as follows:-

Male	152.5 cms.
Female	145.0 cms.

(2) The male candidates will be required to qualify in walking test of 25 kms. to be completed in Four hours and female candidates of 14 kms. to be completed in Four hours. The arrangement for conducting this test will be made by the Chief Conservator of Forests, Uttar Pradesh so as to synchronise with the sittings of the Medical Board.

**PHYSICAL FITNESS : (1)** No candidate shall be appointed to a post in the service unless he be in good mental and bodily health and free from any physical defect likely to interfere with the efficient performance of his duties. Before a candidate is finally approved for appointment by direct recruitment he shall be required to pass an examination by a Medical Board. (2) A female candidate who has a result of test is found to be pregnant of Twelve weeks duration or more should be declared temporarily unfit. She should be re-examined for fitness after Six weeks from the date of confinement.

**Note :** candidates before applying should ensure himself/herself that he/she possesses the above physical standard.

12. **AGE LIMIT :** (I) Candidates must have attained the age of 21 years and must not have crossed the age of 40 years on July 1, 2013 i.e. they must have not been born earlier than 2nd July, 1973 and not later than July 1, 1992. (II) Upper age limit shall be greater by five years for candidates belonging to Scheduled Castes of U.P., Scheduled Tribes of U.P., Other Back Ward classes of U.P., skilled players of U.P. of classified games and state Govt. employees of U.P. i.e. they must have not born before 2nd July, 1968.

continued..



Upper age limit for Emergency Commissioned Officers/Short Service Commissioned Officers/ Ex-Army Personnels of U.P. shall be greater by maximum 5 years only on completion of 5 years service in army. Upper age limit for physically handicapped persons of Society of U.P. will be greater by fifteen years i.e. they must have not born before 2nd July 1958.

**13. SOME INFORMATION ABOUT EXAMINATION AND INTERVIEW :** (1) The dates and venue for the examination shall be informed by the Commission later on through e-Admit Card. (II) All original certificates shall be verified at the time of interview. Candidates will also be required to furnish four passport size Photographs, two unattested and two attested by their Head of Department or Head of the Institution where they received education or by a Gazetted Officer at the time of Interview. (III) Candidates serving under the Central or State Government will have to produce 'No Objection Certificate' from their employer at the time of interview issued by the competent authority. (iv) Candidates will have to fill-up prescribed Application Forms etc. prior to interview.

**NOTE:** The candidates must enclose all certificates in support of their claims rendered in the application form for the examination. If they do not enclose all certificates in support of their all claims, their candidature shall be cancelled.

**14. IMPORTANT INSTRUCTIONS FOR CANDIDATES:** (1) As per decision of the UPPSC a candidate will be liable to be debarred from the examination in question and other examinations and selections upto a maximum period of five years for furnishing any wrong information in his/her application form which cannot be substantiated by relevant documents or for any other malpractice. (2) No change in category, sub-category, Date of Birth etc. is permissible after the receipt of application form in the office of the Commission. In this regard no application for error correction/modification shall be acceptable. (3) The date of birth of the candidates shall be admissible as entered in High School Certificate. The candidate will have to attach his/her High School or Equivalent Examination Certificate with the application form of Examination. No Other Certificate shall be acceptable for Date of Birth and if it is not attached with the application it shall be rejected. (4) The candidates will have to enclose copies of Marksheets, Certificates & Degrees duly attested by any Gazetted Officer or Head of the last institution where education was received in support of their claims of Educational Qualifications. If they do not enclose certificates/documents in support of their claims, the application shall be rejected. (5) The benefit of reservation to the categories of Handicapped persons of society shall be given only on the posts which are identified by the Government for their category. For this benefit the Handicapped persons must produce a certificate of being handicapped in that category on the prescribed proforma issued by prescribed Medical Officer/Specialist and counter signed by the Chief Medical Officer according to Rule 2 of U.P. Public Service (Reservation for physically Handicapped, Dependent of Freedom Fighters and Ex-Serviceman (Amendment) Act, 1997 read with G.O. dated 03 Feb., 2008). The exarmy personnels must be discharged from army upto the last date prescribed for receipt of applications. (6) Date, time and venue etc. of examination along with Roll No. will be communicated to the candidate through e-Admit Cards, Candidates will have to appear at the centre allotted to them by the Commission. No change in centre is permissible. (7) The candidature of such candidates who are subsequently found ineligible according to the terms laid down in advertisement will be cancelled and their any claim for the Examination will not be entertained. The decision of the Commission regarding eligibility of the candidates shall be final. (8) The Application/candidature will be rejected/cancelled if the application is not submitted on prescribed form, date of birth is not mentioned or wrong date of birth is mentioned, overage, under age, not fulfilling the minimum educational qualifications, application received after last date and no signature under declaration in the format. (9) The Commission may admit the candidates provisionally after summary checking of the application but if it is found at any stage that applicant was not eligible or that his/her application should have been rejected or was not entertainable initially, his/her candidature will be rejected and if the candidate is selected, the recommendation of the Commission for appointment shall be withdrawn. (10) The Commission reserves the right of cancelling the candidature of any candidate found indulging in any malpractice i.e. copying in examination hall or indiscipline, misbehaviour or canvassing for his/her candidature. On violation of these instructions, the candidates may be debarred from this examination as well as future examinations. In this regard the decision of the Commission shall be final. (11) In all communications to the Commission, the candidates must mention the name of examination, advertisement no., registration no., date of birth, father's name and also the Roll Number, if communicated. (12) Approximately 3 times candidates shall be called for interview on the basis of examination. It is essential for the candidates to appear in the interview. (13) The candidates who are appearing in graduation examination need not to apply as they are not eligible. (14) While filling the answer sheet the candidates "must use Black Ball Point Pen only". Do not use any other pen or pencil in any condition. (15) The information filled in the "Answer Sheet" must not be erased by Whitener, Blade or Rubber etc..

**GENERAL INSTRUCTIONS**

- In no circumstances, applications shall be accepted after the last prescribed date and time. Applications found without requisite informations and without photograph and signature, even when received in time, will be summarily rejected.
- In the On-line system the candidates must click the submit Button by the Last Date & Time. They must take the print out and keep it safely. In any discrepancy they will have to produce the print out otherwise no request shall be entertained.
- Those candidates, willing to take the benefit of the reservation/age relaxation must obtain a certificate, issued by the competent authority, in support of the reserved category, in the prescribed format printed in this detailed advertisement (**Appendix 8-A**) and submit the same to the Commission, whenever required to do so. Those claiming more than one reserved category/age relaxation will be given only one such concession, which will be more beneficial. The candidates who are not originally domiciled of U.P. belonging to SC, ST, O.B.C., dependants of freedom fighters, P.H. and women are not entitled to benefit of reservation. Such candidates will be treated as general candidates. In case of the women candidates, the certificate issued from father side will be treated valid.
- The Commission do not advise to candidates about their eligibility. Therefore, they should carefully read the advertisement and when satisfied about their eligibility conditions in terms of the advertisement, then only apply. The candidates must possess all the requisite qualifications till the last date for submitting the applications.
- In the category of dependants of the freedom fighters only sons, daughters, grandsons and grand daughters (son's son and daughter) are covered. Only such relationships with the freedom fighters are not adequate but the candidate should remain actually dependant of the freedom fighter. Drawing the attention of the candidates towards Govt. orders dated 22.01.1982, 08.03.1983 and Govt. Order No. 3014, Personnel-2, 1982 dated 18.10.1982 read with Govt. Order No. 6/1972 Personnel-2, 1982 dated 15.01.1983, it is advised that now the candidates must obtain the reservation, certificate from the District Magistrate in terms of Govt. Order No. 4/3/82-Ka-2-97 dated 26.12.1997 in the prescribed format and submit the same.
- In the event of involvement of a candidate in the concealment of any important information, pendency of any case/criminal case, conviction, more than a husband or wife being alive, submission of facts in a distorted manner, malpractice, canvassing for selection etc., the Commission reserves the right to reject the candidature and debar from appearing in the examination in question and all future other examinations and selections.

7. In case the candidates feel any problem in the "On-line Application" they may get their problem resolved by contacting over phone or Website clicking 'Contact us'.

8. The name of Districts for Examination are available in the advertisement in **Appendix-8**. In the same way the plan of Examination and the syllabus on **Appendix-9**.

**Note:** "Detailed instructions to fill in the On-line Applications". have been given from Appendix 1 to 7B. Specimen are given to make candidates familiar with the procedure.

**Detailed Application Form:**

At the top of the page there is a 'Declaration' for the candidates are advised to go through the contents of the **Declaration** carefully. Candidate has the option to either agree or disagree with the contents of Declaration by clicking on 'I Agree' or 'I do not agree' buttons. In case the candidate opts to disagree, the application will be dropped and the procedure will be terminated. Accepting to agree only will submit the candidates Online Application.

**Notification Details**

This section shows information relevant to Notification.

**Personal Details**

This section shows information about candidate personnel details i.e. Registration Number, Candidate name, Father/Husband name, Gender, DOB, UP domicile, Category, Marital status, email and contact number.

**Other Details of candidate**

Other details of candidate shows the information details about UP Freedom Fighter, Ex Army, service duration and your physical deformity.

**Education & Experience Details**

It shows your educational and experience details.

**Candidate address, photo & signature details**

Here you will see your complete communication address and photo with your signature.

**Declaration segment**

At the bottom of the page there is a 'Declaration' for the candidates. Candidates are advised to go through the contents of the **Declaration** carefully.

After filling all above particulars there is provision for preview your detail before final submission of application form on clicking on "Preview" button.

Preview page will display all facts/particulars that you have mentioned on entry time if you are sure with filled details then click on "Submit" button to finally push data into server with successfully submission report that you can print.

Otherwise using "Back" button option you can modify your details.

**[CANDIDATES ARE ADVISED TO TAKE A PRINT OF THIS PAGE BY CLICKING ON THE "Print" OPTION AVAILABLE]**

**For Other information:**

For other information candidates are advised to select desired option in 'Home Page' of Commission's website <http://uppsc.up.nic.in> in CANDIDATE SEGMENT

CANDIDATE SEGMENT	
All Notification / Advertisements	
Candidate Registration (First State)	
Candidate E-Challan/I-Collect (Second State)	
Submit Application Form (Third State)	
View Application Status	
List of Applications Having photo related Objections	
Download Forms for Eligibility Checking	
Download Interview Letter	
Duplicate Regi. Slip & Application form	
Download Syllabus	

**Regarding application :**

- On clicking "View Application status" option in Candidate Segment page you can see current status of candidate.
- On clicking "Result" option in Candidate Segment page candidate can see result status of periodically.
- "Interview/Exam Schedule" option in Candidate Segment page candidate can see interview and examination schedule details periodically.
- On clicking "Key Answer Sheet" candidate can download key answer sheet.
- On clicking "Admit Card/Hall Ticket" candidate can download their Admit Card using with some basic credential of candidate.
- On clicking "List of Rejected Candidate" candidate can view rejected candidate list.
- On clicking "Syllabus" candidate can view syllabus of particular examination.

(Candidates applying on-line need NOT send hard copy of the On-line Application filled by them on-line or any other document/certificate/testimonial to the Uttar Pradesh Public Service Commission. However they are advised to take printout of the On-line Application and retain it for further communication with the UPPSC.) (The Candidates applying for the examination should ensure that they fulfill all eligibility conditions for admission to examination. Their admission at all the stages of the examination will be purely provisional subject to satisfying the prescribed eligibility conditions.) UPPSC takes up verification of eligibility conditions with reference to original documents at subsequent stages of examination process.

**LAST DATE FOR RECEIPT OF APPLICATIONS :** On-line Application process must be completed (including filling up of Part-I, Part-II and Part-III of the Form) before last date of form submission according to Advertisement, after which the web. Link will be disabled.

**Appendix-1**

All Notifications/Advertisements Details									
Candidate Home Page-Notifications/Advertisements									
<span style="float:right">Online Advertisement</span> <span style="float:left">Offline Advertisement</span>									
Advertisement Applicable for online Submission Only									
Name	Selection Type	Advt. Number, Date	Start Date	Fee Deposition Last Date	Form Submission Last Date				
सहायक वन संरक्षक परीक्षा-2013	सामान्य	A.../E-1/2013	01/01/2013	01/01/2013	30/03/2013	30/03/2013	User Instructions	View Advertisement	Apply
परीक्षा का नाम : 'Asstt. Conservator of Forest Exam-2013', विज्ञापन संख्या : ' A-7/E-1/2013 ' विज्ञापन प्रारंभ तिथि : ' , चयन : [ सामान्य ] आयु गणना की तिथि :- 01/07/2013									
Directorate/Department Name	Post/Vacancy Name, Deptt. No.	Nature	Pay Scale	Lower Age	Upper Age	Total No.Of Post	Qualification	Opt Option	
ACF Exam - 2013	ACF Exam - 2013			21	40	163	View	Candidate Registration	

continued..



**Appendix-2**  
Candidate Home Page-Notifications/Advertisements-Candidate Basic Registration

**Asstt. Conservator of Forest Exam-2013**

Advertisement No : A-7/E-1/2013  
Directorate/Department : ACF Exam - 2013  
Post Name : ACF Exam - 2013  
Date for Calculating Age : 01/07/2013

Select Type of Recruitment : सामान्य / सामान्य

**Personnel Information**

1. Candidate Name :  
2. Father/Husband Name :  
3. Are you Domicile of UP? :  
4. Category :  
5. Date Of Birth (DD/MM/YYYY) :  
6. Gender :  
7. Are You Married? :  
8. Contact Number :  
9. Email ID :

**Essential Qualification Details**

Sr. No.	Name	Acquired(Y/N)	Is Grade System	Marks Obtained	Total Mark	Percentage
1.	भारत में विधि द्वारा स्थापित किसी विधायिकात्मक संसदात्मक की उपाधि या श्रेणीक द्वारा इनके समकक्ष मान्यता प्राप्त कोई उपाधि	No	No			

Enter Verification Code :

Submit Cancel Close

**Appendix-3**  
Candidate Registration Acknowledgement

**Uttar Pradesh Public Service Commission**  
Registration Slip Applied for  
Asstt. Conservator of Forest Exam-2013 : A-7/E-1/2013

You have been registered successfully.  
Please note down your Registration Number for future Reference.

**Candidate Registration No. : 10120000084**

Advertisement / Notification No. : A-7/E-1/2013  
Candidate Name : SANDEEP JAISWAL  
Father's / Husband's Name : P. JAISWAL  
Date Of Birth : 01/01/1980  
Are you Domicile of UP? : Yes  
Category : सामान्य  
Gender : पुरुष  
Fee (in INR) : NIL

**Note :-**

- Please Note Down Candidate Registration No. 10120000084 for Future communication with UPPSC.
- Your Application will be treated as incomplete unless accomplished by application form fee and uploading of photograph with signature & the detailed application form submission.
- Submission of detailed application form will be allowed on next working day from 2:00 PM onwards after the deposition of fee through E-Challan in the prescribed bank.
- E-Challan generation from the website will be valid for fee deposition in the prescribed bank upto the last date to fee deposition given in the advertisement only in banking hours.
- Detailed application form submission will be stopped after 23:59 hrs of the last date of form submission given in the advertisement.
- Candidates whose fee amount is NIL in registration slip can submit the detailed application form at the same time without generating E-challan.

\*Please do submission at an early date to avoid delay/problems in submission due to heavy network traffic on the last date.  
[Date : 05/02/2013, Time : 12:02:47]

Print

No need to deposit the fee You can directly submit detailed notification form.

**Submit Application Form**

Select any one of the Payment Mode for Fee Deposition  
E-Challan / Collect

Select any one Bank Name : Please Select..

Click here to Generate E-Challan

**Appendix-4**  
Examination Fee's Payment Details

**Bank E-Challan**

Fee Deposition Last Date: 30/03/2013  
Cash Only

Asstt. Conservator of Forest Examination - A-7/E-1/2013 / ACF 2013

Account Number : 31340979155  
Deposit only through : 'Fee Collection-> UPPSC (Screen No.7125)'  
Refer: Lucknow Circle e-Circular no 93 dated 01.09.2010  
AND Corporate Centre e-Circular no. 551 dated 06.10.2010

Candidate Registration/Challan No. : 10120000109  
Name of Candidate : SANDEEP KUMAR  
Date Of Birth (dd/mm/yyyy) : 01/01/1980  
Fee Amount in figure (Rs.) : Rs. 115/-  
Amount In Word : Rs. One Hundred Fifteen only

Bank Transaction ID/Journal No. \*  
Transaction Date \*  
Bank Officer Signature & Stamp \*  
Candidate Signature :

Select any one Bank Name : State Bank Of India

Enter Verification Code : Pgk5h

Click here to Generate E-Challan Close

\*After taking the Print out of this generated e-Challan, approach to nearest branch of the selected Bank & deposit the fee in cash only. Please ensure that the concerned bank person has written Bank Transaction ID/Journal number and the Transaction Date in the appropriate Place in candidate copy of the e-Challan. After depositing the required fee in the Bank.

Candidate will be able to Submit the Detailed Application Form on the Next working Day after 2:00 PM.

**Appendix-5**  
Bank E-Challan

Fee Deposition Last Date: 30/03/2013  
Cash Only

Asstt. Conservator of Forest Examination - A-7/E-1/2013 / ACF 2013

Account Number : 31340979155  
Deposit only through : 'Fee Collection-> UPPSC (Screen No.7125)'  
Refer: Lucknow Circle e-Circular no 93 dated 01.09.2010  
AND Corporate Centre e-Circular no. 551 dated 06.10.2010

Candidate Registration/Challan No. : 10120000199  
Name of Candidate : SANDEEP KUMAR  
Date Of Birth (dd/mm/yyyy) : 01/01/1980  
Fee Amount in figure (Rs.) : Rs. 115/-  
Amount In Word : Rs. One Hundred Fifteen only

Bank Transaction ID/Journal No. \*  
Transaction Date \*  
Bank Officer Signature & Stamp \*  
Candidate Signature :

State Bank Of India

Enter Verification Code : Pgk5h

Click here to Generate E-Challan Close

\*After taking the Print out of this generated e-Challan, approach to nearest branch of the selected Bank & deposit the fee in cash only. Please ensure that the concerned bank person has written Bank Transaction ID/Journal number and the Transaction Date in the appropriate Place in candidate copy of the e-Challan. After depositing the required fee in the Bank.

Candidate will be able to Submit the Detailed Application Form on the Next working Day after 2:00 PM.

**Appendix-6**  
Bank E-Challan

Fee Deposition Last Date: 30/03/2013  
Cash Only

Asstt. Conservator of Forest Examination - A-7/E-1/2013 / ACF 2013

Account Number : 31340979155  
Deposit only through : 'Fee Collection-> UPPSC (Screen No.7125)'  
Refer: Lucknow Circle e-Circular no 93 dated 01.09.2010  
AND Corporate Centre e-Circular no. 551 dated 06.10.2010

Candidate Registration/Challan No. : 10120000199  
Name of Candidate : SANDEEP KUMAR  
Date Of Birth (dd/mm/yyyy) : 01/01/1980  
Fee Amount in figure (Rs.) : Rs. 115/-  
Amount In Word : Rs. One Hundred Fifteen only

Bank Transaction ID/Journal No. \*  
Transaction Date \*  
Bank Officer Signature & Stamp \*  
Candidate Signature :

Punjab National Bank

Enter Verification Code : hfcaw

Click here to Generate E-Challan Close

**Appendix-6**  
Bank E-Challan

Fee Deposition Last Date: 30/03/2013  
Cash Only

Asstt. Conservator of Forest Examination - A-7/E-1/2013 / ACF 2013

Account Number : 31340979155  
Deposit only through : 'Fee Collection-> UPPSC (Screen No.7125)'  
Refer: Lucknow Circle e-Circular no 93 dated 01.09.2010  
AND Corporate Centre e-Circular no. 551 dated 06.10.2010

Candidate Registration/Challan No. : 10120000199  
Name of Candidate : SANDEEP KUMAR  
Date Of Birth (dd/mm/yyyy) : 01/01/1980  
Fee Amount in figure (Rs.) : Rs. 115/-  
Amount In Word : Rs. One Hundred Fifteen only

Bank Transaction ID/Journal No. \*  
Transaction Date \*  
Bank Officer Signature & Stamp \*  
Candidate Signature :

Punjab National Bank

Enter Verification Code : hfcaw

Click here to Generate E-Challan Close

**Appendix-7**  
Submit detailed application form & scanned photo with signature

**Appendix-7**  
Candidate Home Page-Submit Application Form

Detailed Application Form Submission will be allowed only after 2:00 PM on the next working Day since from the Fee deposition date in the Bank.

Candidate Registration No. : 10120000084

Fee Deposition through E-Challan / Fee amount is NIL

Bank Name : Please Select..

Transaction ID/Journal No. :  
Transaction Date : DAY / MONTH / YEAR Proceed

Please enter personal information and upload scanned file.

**Personnel Information**

Date Of Birth : 01 / Jan / 1980  
Gender : पुरुष  
Are you Domicile of UP? : Yes  
Category : सामान्य

Upload Scanned Photo with Signature File  
Select Scanned File : C:\Users\Administrator\ Browse..

Enter Verification Code : QPAGW

Please enter personal information and upload scanned file.

Submit Cancel

Precautions while entering Transaction ID/Journal Number  
SBI - Please remove characters like '0,1' in the prefix of TRANSACTION ID/JOURNAL NUMBER (if found). Provided by SBI Branch then enter only remaining digits.  
ie. 019951077 or 0019951077 or J19951077 or J019951077 pl. enter only 19951077  
PNB - Please remove character like '-' from the TRANSACTION ID/JOURNAL NUMBER (if found). Provided by PNB Branch then enter only remaining characters and digits.  
ie. M-416965 pl. enter only M416965

**Appendix-7A**  
The Procedure relating to upload Photo & Signature.

**Guide Lines for Scanning Photograph with Signature**

- Paste the Photo on any white paper as per the above required dimensions. Sign in the Signature Space provided. Ensure that the signature is within the box.
- Scan the above required size containing photograph and signature. Please do not scan the complete page.
- The entire image (of size 3.5 cm by 6.0 cm) consisting of the photo along with the signature is required to be scanned, and stored in \*.jpg, .jpeg, .gif, .tif, .png format on local machine.
- Ensure that the size of the scanned image is not more than 50 KB.
- If the size of the file is more than 50 KB, then adjust the settings of the scanner such as the DPI resolution, no. colours etc., during the process of scanning.
- The applicant has to sign in full in the box provided. Since the signature is proof of identity, it must be genuine and in full; initials are not sufficient. Signature in CAPITAL LETTERS is not permitted.
- The signature must be signed only by the applicant and not by any other person.
- The signature will be used to put on the Hall Ticket and wherever necessary. If the Applicant's signature on answer script, at the time of the examination, does not match the signature on the Hall Ticket, the applicant will be disqualified.

**Sample Image & Signature :-**

width= 3.5 cm  
Height= 4.5 cm

Photo  
Signature



Appendix-7B

Submit Application Form for Asstt. Conservator of Forest Examination - 2013 Preliminary Examination

Candidate Home Page-Submit Application Form-Application Full details

All part fields are compulsory

I declare that I have read the user instructions & detailed advertisement

Notification Details	
Notification No	A-7/E-1/2013
Selection Type :	सामान्य
Directorate/Department :	ACF Exam 2013
Post Name :	ACF Exam 2013
Candidate Personnel Details	
1. Applicant Registration No. :	10120000084
2. Candidate Name :	SANDEEP JAISWAL
3. Father/Husband Name :	P. JAISWAL
6. Gender :	Male
4. Date of Birth :	01/01/1980
5. Are you Domicile of UP? :	Yes
6. Category :	General
7. Are you Married? :	No
8. Contact No. :	
9. Email-ID :	
Transaction Details	
10. Bank Name :	0
11. Transaction ID :	0
12. Transaction Date :	//0

Other Details of Candidate	
13. Are you Dependent of UP Freedom Fighter?	No
14. Are you UP Ex. Army?	No
14.1 Service Duration (Day-Month-Year)	0 - 0 - 0
14.2 Retirement Date(Month/Year)	//
15. Are You Handicap of UP?	Yes
15.1 Are you Blind Or Have Vision problem?	No
15.2 Are you Deaf or Have hearing problem?	No
15.3 Have you any physical Problem?	Yes
Sr. No. PH Category [ LOCOMOTOR or CEREBRAL PLASY ] Selected PH Category	
15.3.1 Both Legs affected but not arms [ BL ]	<input type="checkbox"/> BL
15.3.2 Both Arms affected [ BA ]	<input type="checkbox"/> BA
15.3.3 Both Legs and Both Arms affected [ BLA ]	<input type="checkbox"/> BLA
15.3.4 One Leg affected ( right or left ) [ OL ]	<input type="checkbox"/> OL
15.3.5 One Arm affected ( right or left ) [ OA ]	<input checked="" type="checkbox"/> OA
	<input type="checkbox"/> Impaired Reach <input type="checkbox"/> Weakness of grip <input type="checkbox"/> Ataxic
15.3.6 Stiff Back and Hips ( Cannot sit or stoop ) [ BH ]	<input type="checkbox"/> BH
15.3.7 Muscular Weakness and limited physical endurance [ MW ]	<input type="checkbox"/> MW
16. Are You Skilled Player Of UP? :	No

Essential Qualification Details						
17.1 Essential Qualifications & Marks According to Advertisement :-						
Sr No.	Qualification	Acquired	Is Grade System	Obtain Marks	Total Marks	Percentage
1	भारत में विधि द्वारा स्थापित किसी विधायिकात्मक संसद के अंग के सदस्य के रूप में कार्य करने का अधिकार	Yes	No	123.00	150.00	82.00

18. Are You Graduate ? \* Yes

If Yes, Please Select Subject Name -> You are Selected these Subjects :

Please Select the Subject Name

अर्थशास्त्र  
 समाज शास्त्र/समाज विज्ञान  
 कृषि

1. अर्थशास्त्र  
 2. समाजशास्त्र  
 3. कृषि

19. Are You Post Graduate ? \* Yes

If Yes, Please Select Subject Name -> You are Selected these Subjects :

Please Select the Subject Name

अर्थशास्त्र  
 समाज शास्त्र/समाज विज्ञान  
 कृषि

1. अर्थशास्त्र

20. Other Essential Qualification \* Yes

If Yes, Please Select Subject Name -> You are Selected these Subjects :

Please Select the Subject Name

ओएससी या बीएससी (Ag.) के उपरान्त राजकीय कृषि विभाग एवं विद्यालय संस्थापन सहित 15 माह का नवोदय विद्यालय में प्रवेश प्राप्त करना अथवा किसी मान्यता प्राप्त संस्थान से होकर मिले प्रबन्ध और ओशन प्रबन्ध में तीन वर्षीय डिप्लोमा

1. समाज शास्त्र अथवा समाज विज्ञान में स्नातक तथा पोस्ट ग्रेजुएट डिप्लोमा इन कृषि एजुकेशन

21. Are You Know Hindi in Devnagari Lipi ? \* Yes

Candidate's Address, Photo Signature Details	
23. Address :	lucknow
23.1 House no./Village :	123
23.2 Street No./PO :	1
23.3 City Name :	thakurganj
23.4 State Name :	उत्तर प्रदेश
23.5 District Name :	लखनऊ
23.6 PIN :	354365
24. Photo & Signature ?	

I accept the following declaration : Yes

1. I here by declare that I have read all term & condition according advertisement and I accept it.  
 2. I here by declare that all the entires/statements made in this application are true, complete and correct to the best of my knowledge and belief.  
 3. In the event of any information being found false or incorrect or ineligibility being detect before or after selection, the commission can take action against me as per rule incase it is detected that I have misled UPPSC on any issue then I will solely responsible for all penal consequences thereof.

Type Verification Code as displayed in image :- SC29T

Cancel Close Back Submit

Successful Confirmation of Application Form

Candidate Home Page-Submit Application Form-Successfull Confirmation of Application Submission

Print Application ID Slip

Your Application has been submitted successfully. Please note down your Application ID for further Reference.

A-7/E-1/2013 / ACF Exam 2013	
Application ID	200047101000001
Registration Number	10120000084
Candidate Name	SANDEEP JAISWAL
Date of Birth	01/01/1980

Note:- Filled in Application Form has been received in the Commission's office but its Acceptance is subject to the verification process pertaining to the Candidates Age eligibility as per the post/ objections related to photo uploading/Rejected/Accepted etc., So Please Visit the website again to view the application status after the last date of form submission on the website, under the option 'View Application Status' for ensuring the Acceptance of Application form.

Click here to download complete Application Form [Date : 05/02/2013, Time : 12:06:42]

Appendix-8

The name of the districts in which the Examination will be held are Allahabad and Lucknow.

Appendix-8A

उ0प्र0 की अनुसूचित जाति तथा अनुसूचित जनजाति के लिये जाति प्रमाण-पत्र

प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी..... सुपुत्र/सुपुत्री श्री..... निवासी ग्राम..... तहसील..... नगर..... जिला..... उत्तर प्रदेश राज्य की..... जाति के व्यक्ति हैं जिसे संविधान (अनुसूचित जाति) आदेश, 1950 (जैसा कि समय-समय पर संशोधित हुआ) / संविधान (अनुसूचित जनजाति, उत्तर प्रदेश) आदेश, 1967 के अनुसार अनुसूचित जाति/अनुसूचित जनजाति के रूप में मान्यता दी गई है। श्री/श्रीमती/कुमारी..... तथा अथवा उनका परिवार उत्तर प्रदेश के..... ग्राम..... तहसील..... नगर..... जिला..... में सामान्यतया रहता है। स्थान..... हस्ताक्षर..... दिनांक..... पूरा नाम..... मुहर..... पद नाम..... जिलाधिकारी/अतिरिक्त जिलाधिकारी/सिटी मजिस्ट्रेट/परगना मजिस्ट्रेट/तहसीलदार/अन्य वेतन भोगी मजिस्ट्रेट यदि कोई हो/जिला समाज कल्याण अधिकारी

उत्तर प्रदेश के अन्य पिछड़े वर्ग के लिए जाति प्रमाण-पत्र

(प्रारूप-1)

प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी..... सुपुत्र/सुपुत्री श्री..... निवासी ग्राम..... तहसील..... नगर..... जिला..... उत्तर प्रदेश राज्य की..... पिछड़ी जाति के व्यक्ति हैं। यह जाति उत्तर प्रदेश लोक सेवा (अनुसूचित जातियों, अनुसूचित जनजातियों तथा अन्य पिछड़े वर्गों के लिये आरक्षण) अधिनियम, 1994 (यथासंशोधित) की अनुसूची-एक के अन्तर्गत मान्यता प्राप्त है।

यह भी प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी..... पूर्वोक्त अधिनियम, 1994 (यथासंशोधित) की अनुसूची-दो (जैसा कि उत्तर प्रदेश लोक सेवा) (अनुसूचित जातियों, अनुसूचित जनजातियों और अन्य पिछड़े वर्गों के लिये आरक्षण) (संशोधन) अधिनियम, 2001 द्वारा प्रतिस्थापित किया गया है एवं जो उत्तर प्रदेश लोक सेवा (अनुसूचित जातियों, अनुसूचित जनजातियों और अन्य पिछड़े वर्गों के लिये आरक्षण) (संशोधन) अधिनियम, 2002 द्वारा संशोधित की गयी है, से आच्छादित नहीं है। इनके माता-पिता की निरंतर तीन वर्ष की अवधि के लिये सकल वार्षिक आय पाँच लाख रुपये या इससे अधिक नहीं है तथा इनके पास धनकर अधिनियम, 1957 में यथा विहित छूट सीमा से अधिक सम्पत्ति भी नहीं है। श्री/श्रीमती/कुमारी..... तथा/अथवा उनका परिवार उत्तर प्रदेश के ग्राम..... तहसील..... नगर..... जिला..... में सामान्यतया रहता है।

स्थान..... हस्ताक्षर..... दिनांक..... पूरा नाम..... मुहर..... पद नाम..... जिलाधिकारी/अतिरिक्त जिलाधिकारी/सिटी मजिस्ट्रेट/परगना मजिस्ट्रेट/तहसीलदार।

उ.प्र. के विकलांगों के लिए प्रमाण-पत्र

CERTIFICATE FOR PHYSICALLY HANDICAP OF U.P.

NAME & ADDRESS OF THE INSTITUTE/HOSPITAL Certificate No. .... Date .....

DISABILITY CERTIFICATE

This is to certified that Shri/Smt/Kum..... son/wife/daughter of Shri..... age..... Sex..... identification mark (s)..... is suffering from permanent disability of following category.

- A. Locomotor or cerebral palsy:
- (i) BL-Both legs affected but not arms.
  - (ii) BA-Both arms affected
  - (a) Impaired reach (b) Weakness or grip
  - (iii) BLA-Both legs and both arms affected
  - (iv) OL-One leg affected (right or left)
  - (a) Impaired reach (b) Weakness of grip (c) Ataxic
  - (v) OA-One arm affected
  - (a) Impaired reach (b) Weakness of grip (c) Ataxic
  - (vi) BH-Stiff back and hips (Cannot sit or stood)
  - (vii) MW- Muscular weakness and limited physical endurance
- B. Blindness or Low Vision: (i) B-Blind (ii) PB-Partially Blind
- C. Hearing impairment: (i) D-Deaf (ii) PD-Partially Deaf (Delete the category whichever is not applicable)
2. This condition is progressive/non-progressive/likely to improve/not likely to improve. Re-assessn of this case is not recommended/is recommended after a period of ..... year ..... months.
3. Percentage of disability in his/her case is ..... percent.
4. Sh./Smt./Kum. .... meets the following physical requirements discharge of his/her duties:
- (i) F-can perform work by manipulating with fingers. Yes/No
  - (ii) PP-can perform work by pulling & pushing. Yes/No
  - (iii) L-can perform work by lifting. Yes/No
  - (iv) KC-can perform work by kneeling and crouching. Yes/No
  - (v) B-can perform work by bending. Yes/No
  - (vi) S-can perform work by sitting. Yes/No
  - (vii) ST-can perform work by standing. Yes/No
  - (viii)W-can perform work by walking Yes/No
  - (ix) SE-can perform work by seeing. Yes/No
  - (x) H-can perform work by hearing/speaking. Yes/No
  - (xi) RW-can perform work by reading and writing. Yes/No
- (Dr. ....) (Dr. ....) (Dr. ....)  
 Member Member Chairperson  
 Medical Board Medical Board Medical Board  
 Countersigned by the Medical Superintendent/CMO/HQ Hospital (with seal)

Recent photograph of the candidate showing the disability duly attested by the Chairperson of the Medical Board

उ.प्र. के स्वतंत्रता संग्राम सेनानियों के आश्रितों के लिए प्रमाण-पत्र

प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी..... निवासी..... ग्राम..... तहसील..... नगर..... जिला..... उत्तर प्रदेश लोक सेवा (शासिक रूप से विकलांग, स्वतंत्रता संग्राम सेनानियों के आश्रित और भूतपूर्व सैनिक के लिए आरक्षण) अधिनियम 1993 के अनुसार स्वतंत्रता संग्राम सेनानी हैं और श्री/श्रीमती/कुमारी (आश्रित)..... पुत्र/पुत्री/पौत्र/पौत्री उपराकित अधिनियम 1993 के ही प्रावधानों के अनुसार उक्त श्री/श्रीमती (स्वतंत्रता संग्राम सेनानी)..... के आश्रित हैं। हस्ताक्षर..... पूरा नाम..... मुहर..... जिलाधिकारी..... सील.....

कुशल खिलाड़ियों के लिये प्रमाण-पत्र जो उ.प्र. के मूल निवासी हैं

शासनादेश संख्या-22/21/1983-कार्मिक-2 दिनांक 28 नवम्बर, 1985 प्रमाण-पत्र के फार्म - 1 से 4 प्रारूप -1 (मान्यता प्राप्त क्रीड़ा/खेल में अपने देश की ओर से अन्तर्राष्ट्रीय प्रतियोगिता में भाग लेने वाले खिलाड़ी के लिये) सम्बन्धित खेल की राष्ट्रीय फेडरेशन/राष्ट्रीय एसोसिएशन का नाम..... राज्य सरकार की सेवाओं/पदों पर नियुक्ति के लिए कुशल खिलाड़ियों के लिए प्रमाण-पत्र प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी..... आत्मज/पत्नी/आत्मजा श्री..... निवासी..... पूरा पता..... दिनांक..... से दिनांक..... तक..... (स्थान का नाम) में आयोजित..... (क्रीड़ा/खेल-कूद का नाम) की प्रतियोगिता/टूर्नामेन्ट में देश की ओर से भाग लिया। उनके टीम के द्वारा उक्त प्रतियोगिता/टूर्नामेन्ट में..... स्थान प्राप्त किया गया। यह प्रमाण-पत्र राष्ट्रीय फेडरेशन/राष्ट्रीय एसोसिएशन/(यहाँ संस्था का नाम दिया जाये)..... में उपलब्ध रिकार्ड के आधार पर दिया गया है। स्थान..... हस्ताक्षर..... दिनांक..... नाम..... पद..... संस्था का नाम..... मुहर..... नोट : यह प्रमाण-पत्र नेशनल फेडरेशन/नेशनल एसोसिएशन के सचिव द्वारा व्यक्तिगत रूप से किये गये हस्ताक्षर होने पर ही मान्य होगा।



## प्रारूप - 2

(मान्यता प्राप्त क्रीड़ा/खेल में अपने प्रदेश की ओर से राष्ट्रीय प्रतियोगिता में भाग लेने वाले खिलाड़ी के लिये) सम्बन्धित खेल की प्रदेशीय एसोसिएशन का नाम ..... राज्य सरकार की सेवाओं/पदों पर नियुक्ति के लिए कुशल खिलाड़ियों के लिए प्रमाण-पत्र प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी ..... आत्मज/पत्नी/आत्मजा श्री ..... निवासी (पूरा पता) ..... ने दिनांक ..... से दिनांक ..... तक ..... में (क्रीड़ा/खेल-कूद का नाम) की प्रतियोगिता (टूर्नामेन्ट स्थान का नाम) ..... आयोजित राष्ट्रीय ..... में (क्रीड़ा/खेल-कूद का नाम) की प्रतियोगिता/टूर्नामेन्ट में देश की ओर से भाग लिया। उनके टीम के द्वारा उक्त प्रतियोगिता/टूर्नामेन्ट में ..... स्थान प्राप्त किया गया। यह प्रमाण-पत्र ..... (प्रदेशीय संघ का नाम) में उपलब्ध रिकार्ड के आधार पर दिया गया है।

स्थान ..... हस्ताक्षर.....  
दिनांक ..... नाम.....  
पद.....  
संस्था का नाम.....  
पता.....  
मुहर.....

नोट : यह प्रमाण-पत्र प्रदेशीय खेल-कूद संघ के सचिव द्वारा व्यक्तिगत रूप से किये गये हस्ताक्षर होने पर ही मान्य होगा।

## प्रारूप - 3

(मान्यता प्राप्त क्रीड़ा/खेल में अपने विश्वविद्यालय की ओर से अन्तर्विश्वविद्यालय प्रतियोगिता में भाग लेने वाले खिलाड़ी के लिये) विश्वविद्यालय का नाम ..... राज्य स्तर की सेवाओं/पदों पर नियुक्ति के लिए कुशल खिलाड़ियों के लिए प्रमाण-पत्र प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी ..... आत्मज/पत्नी/आत्मजा श्री ..... निवास (पूरा नाम) ..... विश्वविद्यालय की कक्षा ..... के विद्यार्थी ने दिनांक ..... से दिनांक ..... तक ..... (स्थान का नाम) में आयोजित अन्तर्विश्वविद्यालय ..... (क्रीड़ा/खेल-कूद का नाम) प्रतियोगिता/टूर्नामेन्ट में ..... विश्वविद्यालय की ओर से भाग लिया। उनके टीम के द्वारा उक्त प्रतियोगिता/टूर्नामेन्ट में ..... स्थान प्राप्त किया गया। यह प्रमाण-पत्र डीन ऑफ स्पोर्ट्स अथवा इंचार्ज खेल कूद ..... विश्वविद्यालय में उपलब्ध रिकार्ड के आधार पर दिया गया है।

स्थान ..... हस्ताक्षर.....  
दिनांक ..... नाम.....  
पद.....  
संस्था का नाम.....  
मुहर.....

नोट : यह प्रमाण-पत्र विश्वविद्यालय के डीन ऑफ स्पोर्ट्स या इंचार्ज खेल-कूद द्वारा व्यक्तिगत रूप से किये गये हस्ताक्षर होने पर ही मान्य होगा।

## प्रारूप - 4

(मान्यता प्राप्त क्रीड़ा/खेल में अपने स्कूल की ओर से राष्ट्रीय खेल-कूद में भाग लेने वाले खिलाड़ी के लिये) डाइरेक्ट्रेट ऑफ पब्लिक इन्स्ट्रक्शन्स/निदेशक, शिक्षा, उत्तर प्रदेश ..... राज्य स्तर की सेवाओं/पदों पर नियुक्ति के लिए कुशल खिलाड़ियों के लिए प्रमाण-पत्र प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी ..... आत्मज/पत्नी/आत्मजा श्री ..... निवासी (पूरा पता) ..... में ..... स्कूल में कक्षा ..... के विद्यार्थी ने दिनांक ..... से दिनांक ..... तक ..... (स्थान का नाम) में आयोजित स्कूलों के नेशनल गेम्स की ..... (क्रीड़ा/खेल-कूद का नाम) प्रतियोगिता/टूर्नामेन्ट में ..... स्कूल की ओर से भाग लिया। उनके टीम के द्वारा उक्त प्रतियोगिता/टूर्नामेन्ट में ..... स्थान प्राप्त किया गया। यह प्रमाण-पत्र डाइरेक्ट्रेट ऑफ पब्लिक इन्स्ट्रक्शन्स/शिक्षा में उपलब्ध रिकार्ड के आधार पर दिया गया है।

स्थान ..... हस्ताक्षर.....  
दिनांक ..... नाम.....  
पद.....  
संस्था का नाम.....  
मुहर.....

नोट : यह प्रमाण-पत्र निदेशक/या अतिरिक्त/संयुक्त या उपनिदेशक डाइरेक्ट्रेट ऑफ पब्लिक इन्स्ट्रक्शन्स/शिक्षा ..... द्वारा व्यक्तिगत रूप से हस्ताक्षर होने पर मान्य होगा।

## APPENDIX-9

## SECTION-I

## PLAN OF EXAMINATION AND SYLLABUS

The competitive examination for the post of Assistant Conservator of Forests Exam-2013 comprises :

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

Paper I	General Hindi	300 Marks
Paper II	General Studies	300 Marks Objective Type
Paper III	Any two subjects to be selected	200 Marks
Paper IV	from the list of the optional	for
Paper V	subjects. Given out in para 2 below.	each paper
Paper VI	Each subject will have two papers.	

(B) Interview for personality test (See Section II of this Appendix) of such candidates as may be called by the Commission. Maximum marks- 150.

2. List of optional Subjects :

Subject	Code
(i) Agriculture	01
(ii) Agriculture Engineering	02
(iii) Botany	03
(iv) Chemistry	04
(v) Chemical Engineering	05
(vi) Civil Engineering	06
(vii) Forestry	07
(viii) Geology	08
(ix) Mathematics	09
(x) Mechanical Engineering	10
(xi) Physics	11
(xii) Statistics	12
(xiii) Zoology	13

Provided that the candidates will not be allowed to offer the following combination of subjects:

- (a) Agriculture and Agricultural Engineering  
(b) Chemistry and Chemical Engineering  
(c) Mathematics and Statistics  
(d) Of the Engineering subjects viz. Agricultural Engineering, Chemical Engineering, Civil Engineering and Mechanical Engineering not more than one subject.

**Note :** The standard and syllabus of the subjects mentioned above are given in schedule to this appendix.

## GENERAL

- All the question papers for the examination will be of conventional (essay) type but general studies will be objective type.
- All question papers must be answered in Hindi or English. Question papers will be set in Hindi and English.
- The duration of each of the papers referred to above will be three hours but general studies will be two hours.

## SECTION-II

## Personality Test

The candidates will be interviewed by a Board of competent and unbiased observers. Personality test will be 150 marks.

## SCHEDULE

The standard of papers in General Hindi and General Studies will be such as may expected of a Science or Engineering graduate of an Indian University.

THE SCOPE OF THE SYLLABUS FOR OPTIONAL SUBJECT PAPERS FOR THE EXAMINATION IS BROADLY OF THE HONOURS DEGREE LEVEL. I.E. A LEVEL HIGHER THAN THE BACHELORS DEGREE AND LOWER THAN THE MASTERS DEGREE. IN THE CASE OF ENGINEERING SUBJECT, THE LEVEL CORRESPONDS TO THE BACHELORS DEGREE.

## सामान्य हिन्दी

- दिए हुए गद्य खण्ड का अवबोध एवं प्रश्नोत्तर।
- संक्षेपण।
- सरकारी एवं अर्द्ध सरकारी पत्र लेखन, तार लेखन, कार्यालय आदेश, अधि सूचना, परिपत्र।
- शब्द-ज्ञान एवं प्रयोग-  
अ. उपसर्ग एवं प्रत्यय प्रयोग  
ब. विलोम शब्द  
स. वाक्यांश के लिए एक शब्द  
द. वर्तनी एवं वाक्य शुद्धि
- लोकोक्ति एवं मुहावरे

## GENERAL STUDIES

General Studies including knowledge of current events and of such matters of everyday observation and experience in their scientific aspects as may be expected of 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 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, multi-storey, relay and inter-cropping, 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, scops 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 multiplications; 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 fertiliser 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 water-logged soils, quality of irrigation water, effect of industrial effluents on soils 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 co-operatives 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 laborers; 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, euploids and aneuploids, 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.

History of plant breeding, Modes of reproduction, selfing and crossing techniques, Origin and evolution of crop plants, centre of origin, law of homologous series, crop genetic resources-conservation and utilization, Application of principles of plant breeding to the Improvement of major field crops. Pure-line selection, pedigree, mass and recurrent selections, combining ability, its significance in plant breeding. Hybrid vigour and its exploitation, backcross method of breeding, breeding for disease and pest resistance, role of interspecific and intergeneric hybridization. Role of biotechnology in plant breeding. Improved varieties, hybrids, composites of various crop plants.

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 nonaerobic respiration; c, c and CAM mechanisms, Carbohydrate, protein and fat metabolism.

Growth and development; photoperiodism 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, vegetables 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.

Diseases and pests of field vegetables, orchard and plantation crops of India. Causes and classification of plant pests and diseases. Principles of control of plant pests and diseases. Biological control of pests and diseases. Integrated pest and disease management. Epidemiology and forecasting. Pesticides, their formulations and modes of action. Compatibility with rhizobial inoculants. Microbial Toxins, 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

**1. Soil and Water Conservation:** Scope of - Soil and water conservation. Mechanics and types of erosion, their causes. **Mechanics and types of erosion, their causes.** Rainfall, runoff and sedimentation relationships and their measurement. Soil erosion control measures-biological and engineering including stream bank protection-vegetative, barriers, contour bunds, contour trenches, contour stone walls, contour ditches, terraces, outlets and grassed waterways. Gully control structures-temporary and permanent-design of permanent soil conservation structures such as chute, drop and drop inlet spiliways. Design of farm, ponds and percolation ponds. Principles-of flood control-flood routing. Watershed Management-investigation, planning and implementation-selection of priority areas and water shed work plan, water harvesting and moisture conservation. Land development-levelelling, estimation of earth volumes and costing. Wind Erosion process-design of shelter belts and wind brakes and their management. Forest (Conservation) Act.

**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

**3. Irrigation and Drainage:** Sources of water for irrigation. Planning and design of minor irrigation projects. Techniques of measuring soil moisture-laboratory and in situ, soil-water plant relationships. Water requirement of crops. Planning conjunctive use of surface and ground water. Measurement of irrigation water, measuring devices-orifices, weirs and flumes. Methods of irrigation-surface, sprinkler and drip, fertigation. Irrigation efficiencies and their estimation. Design and construction of canals, field channels, underground pipelines, head-gates, diversion boxes and structures for road crossing.

Occurrence of ground water, hydraulics of wells, types of wells (tube wells and open wells) and their construction. Well development and testing. Pumps-types, selection and installation. Rehabilitation of sick and failed wells.

Drainage causes of water logging and salt problems. Methods of drainage-drainage of irrigated and unirrigated lands, design of surface, sub-surface and vertical drainage systems. Improvement and utilization of poor quality water. Reclamation of saline and alkali soils. Economics of irrigation and drainage systems. Use of waste water for irrigation-standards of waste water for sustained irrigation, feasibility and economics.

**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. Commonbuilding materials used in construction-timber, brick, stone, tiles, concrete etc. and their properties. Water supply, drainage and sanitation systems.

##### PAPER-II SECTION 'A'

**1. Farm power and machinery:** Agricultural mechanization and its scope. Sources of farm power-animate and electromechanical, Thermodynamics, construction and working of internal combustion engines. Fuel, ignition, lubrication, cooling and governing system of IC engines. Different types of tractors and power tillers. Power transmission, ground drive, power take off (p.t.o.) and control system. Operation and maintenance of farm machinery for primary and secondary tillage. Traction theory, Sowing transplanting and interculture implements and tools. Plant protection equipment-spraying and dusting. Harvesting, threshing and combining equipment. Machinery for earth moving and land development-methods and cost estimation. Ergonomics of man-machine system. Machinery for horticulture and agro-forestry, feeds and forages. Haulage of agricultural and forest produce.

**2. Agro-energy:** Energy requirements of agricultural operations and agroprocessing. Selection, Installation, safety and maintenance of electric motors for agricultural applications. Solar (thermal and photovoltaic), wind and biogas energy and their utilization in agriculture, gasification of biomass for running IC engines and for electric power generation. Energy efficient cooking stoves and alternate cooking fuels. Distribution of electricity for agricultural and agro-industrial applications.

##### Section 'B'

**3. Agricultural Process Engineering:** Post harvest technology of crops and its scope. Engineering properties of agricultural produces and by products. Unit operations cleaning grading, size reduction, densification, concentration, drying/dehydration, evaporation, filtration, freezing and packaging of agricultural produces and by-products. Material handling equipment-belt and screw conveyors, bucket elevators, their capacity and power requirement.

Processing of milk and dairy products- homogenisation, cream separation, pasteurization, sterilization, spray and roller drying, butter making, Ice cream, cheese and shrikhand manufacture. Waste and by product utilization rice husk, rice bran, sugarcane bagasse, Plant residues and coir pith.

**4. Instrumentation and computer applications in Agricultural Engineering:** Electronic devices and other characteristics rectifiers, amplifiers, oscillators, multivibrators, Digital circuits-sequential and combinational system. Application of microprocessors in data acquisition and control of agricultural engineering processes-measurement systems for level, flow, strain, force, torque, power, pressure, vacuum and temperature. Computer-introduction, input/output devices, central processing unit, memory devices, operating systems, processors, keyboards and printers. Algorithms, flowchart specification, programme translation and problem analysis in Agricultural Engineering. Multimedia and Audio-Visual aids.

##### BOTANY PAPER-I

**1. Microbiology and Plant Pathology:** Viruses; bacteria and plasmids-structure and reproduction, General account of infection, Phytoimmunology. Applications of microbiology in agriculture, industry, medicine and pollution control in air, soil and water.

Important plant diseases caused by viruses, bacteria, mycoplasma, fungi nematodes. Mode

of infection and dissemination. Molecular basis of infection and disease resistance/defence. Physiology of parasitism and control measures, Fungal toxins.

**2. Cryptogams:** Algae, Fungi, Bryophytes Pteridophytes-structure and reproduction from evolutionary view point. Distribution of Cryptogams in India and their economic potential.

**3. Phanerogams Gymnosperms:** Concept of Progymnosperms, Classification and distribution of Gymnosperms. Salient features of Cycadales, Coniferales and Gnetales, their structures and reproduction, General account of Cycadofilicales, Bennettitales and Cordaitales.

**Angiosperms:** Systematics, anatomy, embryology, palynology and phylogeny. Comparative account of various systems of Angiosperm Classification. Study of angiospermic families-Magnoliaceae, Ranunculaceae, Brassicaceae (Cruciferae), Rosacea Leguminosae, Euphorbiaceae, Malvaceae, Dipterocarpaceae Apiaceae (Umbelliferae), Asclepiadaceae Verbenaceae, Solanaceae, Rubiaceae Cucurbitaceae, Asteraceae (Composite) Poaceae (Gramineae), Arecaceae (Palmae), Liliaceae, Musaceae, Orchidaceae.

Stomata and their types. Anomalous secondary growth, Anatomy of C3 and C4 plants.

Development of male and female gametophytes, pollination, fertilization, Endosperm-its development and function. Patterns of embryo development, Polymybrony, apoxmis, Applications of palynology.

**4. Plant Utility and Exploitation:** Origin of cultivated plants, Vavilovs centres of origin. Plants as sources for food, fodder, fibres, spices, beverages, drugs, narcotics, insecticides, timber, gums, resins and dyes. Latex, cellulose Strach and their products. Perfumery, importance of Ethnobotany in Indian context. Energy plantation, Botanical Gardens and Herbaria.

**5. Morphogenesis:** Totipotency, polarity, symmetry and differentiation, Cell, tissue, organ and protoplast culture, Somatic hybrids and Cybrids.

##### PAPER-II

**1. Cell Biology:** Techniques of Cell Biology, Prokaryotic and eukaryotic cells- structural and Ultrastructural details. Structure and function of extracellular matrix of ECM (cell wall) and membranes-cell adhesion, membrane transport and vesicular transport-structure and function of cell organelles (chloroplasts, mitochondria, ER, ribosome's, endosomes, lysosomes, peroxisomes, hydrogenosome). Nucleus, nucleolus, nuclear pore complex, Chromatin and nucleosome. Cell signalling and cell receptors. Signal transduction (G-1 proteins, etc.), Mitosis and meiosis; molecular basis of cell cycle. Numerical and structural variations in chromosomes and their significance. Study of polytene, lampbrush and B-chromosomes-structure, behaviour and significance.

**2. Genetics, Molecular Biology and Evolution :** Development of genetics, and geneversus allele concepts (Pseudoalleles). Quantitative genetics and multiple factors. Linkage and crossing over- methods of gene mapping including molecular maps (idea of mapping function). Sex chromosomes and sexlinked 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. Structure and synthesis of nucleic acids and protines. Genetic code and regulation of gene expression. Multigene families.

Organic evolution-evidences, mechanism and theories. Role of RNA in origin and evolution.

**3. Plant Breeding, Biotechnology an Bio-statistics:** Methods of plant breeding introduction, selection and hybridisation' (pedigree, backcross, mass selection, bulk method). Male sterility and heterosis breeding. Use of apomixes in plant breeding. Micropropagation and genetic and genetic engineering methods of transfer of genes and transgenic crops; development and use of molecular markers in plant breeding, Standard deviation and coefficient of variation (CV). Tests of significance (Z-test, t-test and chi-square tests). Probability and distributions (normal, binomial and Poisson distributions), Correlation and regression.

**4. Physiology and Biochemistry:** Water relations, Mineral nutrition and ion transport, mineral deficiencies. Photosynthesis-photochemical reactions, photophosphorylation and carbon pathways including C pathway (photorespiration), C, C and CAM pathways. Respiration (anaerobic and aerobic, including fermentation)-electron transport chain and oxidative phosphorylation, Chemiosmotic theory and ATP synthesis. Nitrogen fixation and nitrogen metabolism. Enzymes, coenzymes, energy transfer and energy conservation. Importance of secondary metabolites. Pigments as photoreceptors (plastidial pigments and phytochrome). Photoperiodism and flowering, vernalization, senescence. Growth substances-their chemical nature, role and applications in agri-horticulture, growth indices, growth movements. Stress physiology (heat, water, salinity, metal). Fruit and seed physiology. Dormancy, storage and germination of seed. Fruit ripening-its molecular basis and manipulation.

**5. Ecology and Plant Geography:** Ecological factors, Concepts and dynamics of community. Plant succession. Concepts of biosphere, Ecosystems and their conservation. Pollution and its control (including phytoremediation). Forest types of India-afforestation, deforestation and social, forestry. Endangered plants, endemism and Red Data Books. Biodiversity, Convention of Biological Diversity, Sovereign Rights and Intellectual Property Rights. Biogeochemical cells, Global warming.

##### CHEMISTRY PAPER-I

##### 1. Atomic Structure

Quantum theory, Heisenberg's uncertainty principle, Schrodinger 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: H<sub>2</sub><sup>+</sup>, H<sub>2</sub> to Ne<sub>2</sub> NO, CO, HF, CN, CN, BeH<sub>2</sub> and CO<sub>2</sub>. Comparison of valence bond and molecular orbital theories, bond order, bond strength and bond length.

##### 3. Solid State

Forms of solids, law of constancy of interfacial angles, crystal systems and crystal classes (crystallographic groups). Designation of crystal faces, lattice structures and unit cell. Laws of rational indices. Bragg's law. X-ray diffraction by crystals. Close packing, radius ratio rules, calculation of some limiting radius ratio values. Structures of NaCl, ZnS, CsCl, CaF<sub>2</sub>, CdI<sub>2</sub> and rutile. Imperfection in crystals, stoichiometric and nonstoichiometric defects. Impurity defects, semi-conductors, Elementary study of liquid crystals.

##### 4. The gaseous state

Education of state for real gases, Intermolecular Interactions, liquification of gases and critical phenomena, Maxwell's distribution of speeds, intermolecular collisions, collisions of 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

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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; electro-chemical 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; over-potential; electro-analytical techniques-voltameter, 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 gases 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 of 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 polynuclear complexes; trans effect and its theories; kinetics of substitution reaction in square-planar complexes; thermodynamic and kinetic stability of complexes.

(c) Synthesis and structures of metal carbonyls; carboxylate anions, carbonyl hydrides and metal nitrosyl compounds.

(d) Complexes with aromatic systems, synthesis, structure and bonding in metal olefin complexes, alkyne complexes and cyclopentadienyl complexes; coordinate 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

Reaction in liquid  $\text{NH}_3$ , HF,  $\text{SO}_2$  and  $\text{H}_2\text{SO}_4$ . 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, sydones.

**2. (a) Reaction mechanisms:** General methods (both kinetic and non-kinetic) of study of mechanism or organic reactions illustrated by examples-use of isotope 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 carbonium ions, carbanions, free radicals, carbenes, benzyne and nitrenes.

**(c) Substitution reactions:**  $\text{SN}1$ ,  $\text{SN}2$ ,  $\text{SNi}$ ,  $\text{SN}1'$ ,  $\text{SN}2'$ ,  $\text{SNi}'$  and  $\text{SRN}1$  mechanisms; neighbouring group participation; electrophilic and nucleophilic reactions of aromatic compound including simple heterocyclic compounds-pyrrole, furan thiophene, indole.

**(d) Elimination reactions:**  $\text{E}1$ ,  $\text{E}2$  and  $\text{E}1\text{cb}$  mechanism; orientation in  $\text{E}2$  reactions-Saytzeff and Hofmann; pyrolytic syn elimination-acetate pyrolysis, Chugaev and Cope eliminations.

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

**(f) Rearrangements:** Pinacol-pinacolone, Hoffmann, Beckmann, Baeyer-Villiger, Favorskii, Fries, Claisen, Cope, Stevens and Wagner Meerwein rearrangements.

**3. Pericyclic reactions :** Classification and examples; Woodward-Hoffmann, rules-electrocyclic reactions, cycloaddition reactions [2+2 and 4+2] and sigmatropic shifts [1, 3; 3,3 and 1,5] FMO approach.

#### 4. Chemistry and mechanism of reactions:

Aldol condensation (including directed aldol condensation), Claisen condensation, Dieckmann, Perkin, Knoevenagel, Witting, Clemmensen, Wolff-Kishner, Cannizzaro and von Richter reactions; Stobbe, benzoin and acyloin condensations; Fischer indole synthesis, Skraup synthesis, Bischler- Napieralski, Sandmeyer, Reimer-Tiemann and Reformatsky reactions.

#### 5. Polymeric Systems

**(a) Physical chemistry of polymers:** Polymer solution 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:**  $\text{OsO}_4$ ,  $\text{HIO}_4$ ,  $\text{CrO}_3$ ,  $\text{Pb}(\text{OAc})_2$ ,  $\text{SeO}_2$ , NBS,  $\text{B}_2\text{H}_6$ , Na-Liquid  $\text{NH}_3$ ,  $\text{LiAlH}_4$ ,  $\text{NaBH}_4$ ,  $n\text{-BuLi}$ , MCPBA.

**7. Photochemist:** 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.  $N \rightarrow p^*$  and  $p \rightarrow p^*$  transitions; application to conjugated double bonds and conjugated carbonyls-Woodward Fieser rules.

**d) Nuclear magnetic resonance:** Isochronous and anisochronous protons; chemical shift and coupling constant; Application of  $^1\text{H}$  NMR to simple organic molecules.

**e) Mass spectra:** Parent peak, base peak, daughter peak, metastable peak, fragmentation of simple organic molecule a cleavage, McLafferty rearrangement.

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

#### CHEMICAL ENGINEERING

##### PAPER-I

##### Section A

#### a) Fluid and Particle Dynamics

Viscosity of fluids, Laminar and turbulent flows, Equation of continuity and Navier-Stokes equation- Bernoulli's theorem. Flow meters. Fluid drag and pressure drop due to friction Reynold's Number and friction factor-effect of pipe roughness. Economic pipe diameter. Pumps, water, air/stream jet ejectors, compressors, blowers and fans, agitation and mixing of liquids, Mixing of solids and pastes. Crushing and Grinding Principles and equipment. Rittinger's and Bond's laws. Filtration and filtration equipment. Fluid- particle mechanics-free and hindered setting. Fluidisation and minimum fluidisation velocity, concepts of compressible and incompressible flow. Transport of solids.

#### b) Mass Transfer

Molecular diffusion coefficient, First and second law and diffusion, mass transfer coefficients, film and penetration theories of mass transfer, Distillation, simple distillation, relative volatility, fractional distillation, plate and packed columns of distillation. Calculation of packed columns for distillation. Calculation of theoretical number of plates. Liquid-liquid equilibria. Extraction-theory and practice; design of gas-absorption columns, Drying, Humidification, dehumidification, Crystallisation, Design of equipment.

#### c) Heat Transfer

Conduction, thermal conductivity, extended surface heat transfer. Convection-free and forced. Heat transfer coefficients-Nusselt Number. LMTD and effectiveness. NTU methods for the design of Double Pipe and Shell & Tube Heat Exchangers, Analogy between heat and momentum transfer, Boiling and condensation heat transfer, single and multiple-effect evaporators. Radiation- Stefan-Boltzman Law, emissivity and absorptivity. Calculation of heat load of a furnace, Solar heaters.

##### SECTION-B

#### d) Novel Separation Processes:

Equilibrium separation processes-exchange, osmosis, electro-dialysis, reverse osmosis, ultra-filtration and other membrane processes, Molecular distillation. Super critical fluid extraction.

**e) Process Equipment design:** Factors affecting vessel design criteria Cost considerations, Design of storage vessels-vertical, horizontal spherical, under-ground tanks for atmospheric and higher pressure. Design of closures flat and elliptical head. Design of supports. Materials of construction-characteristics and selection.

**f) Process Dynamics and Control:** Measuring instruments of process variable like level, pressure, flow, temperature pH and concentration with indication in visual/ pneumatic/analog/ digital signal forms. Control variable, manipulative variable and load variables. Linear control theory-Laplace, transforms. PID controllers. Block diagram representation, Transient and frequency response, stability of closed loop system. Advanced control strategies. Computer based process 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** Laws of thermodynamics. PVT relationship for pure components and mixture, Energy functions and inter-relationships-Maxwells relations, Fugacity, activity and chemical potential. Vapour-liquid equilibria, for ideal/non-ideal, single and multi component systems. Criteria for chemical reaction equilibrium, equilibrium constant and equilibrium conversions, Thermodynamic cycles-refrigeration and power.

#### (c) Chemical Reaction Engineering

Batch reactors-kinetics of homogeneous reactions and interpretation of kinetic data. Ideal flow reactors-CSTR, plug flow reactors and their performance equations. Temperature effects and run-away reactions. Heterogeneous reactions-catalytic and non-catalytic and gas-solid and gas-liquid reactions. Intrinsic kinetics and global rate concept. Importance of interphase and intraparticle mass transfer on performance. Effective-nessfactor. Isothermal and non isothermal reactors and reactor stability.

##### SECTION-B

#### (d) Chemical Technology

Natural organic products-Wood and wood-based chemicals, pulp and paper, Agro-industries-sugar, Edible oils extraction (Including tree based seeds), Soaps and detergents, Essential oils- Biomass gasification (including biogas), Coal and coal chemical, Petroleum and Natural gas- Petroleum refining (Atmospheric distillation/cracking/reforming) Petrochemical industries-Polyethylene's (LDPE/HDPE/LLDPE), Polyvinyl Chloride, Polystyrene, Ammonia manufacture, Cement and lime industries, Paints and varnishes. Glass and ceramics Fermentation-alcohol and antibiotics.

**(e) Environmental Engineering and Safety** Ecology and Environment. Sources of pollutants in air and water, Green house effect, ozone layer depletion, acid rain. Micrometeorology and dispersion of pollutants in environment, Measurement techniques of pollutant levels and their control strategies. Solid wastes, their hazards and their disposal techniques, Design and performance analysis of pollution control equipment. Fire and explosion hazards rating HAZOP and HAZAN, Emergency planning, disaster management, Environmental legislations-water, air environment protection Acts. Forest (Conservation) Act.

#### (f) Process Engineering Economics

Fixed and working capital requirement for a process industry and estimation methods. Cost estimation and comparison of alternatives. Net present value by discounted cash flow. Pay back analysis. IRR, Depreciation, taxes and insurance, Break-even point analysis. Project scheduling-PERT and CPM, Profit and loss account, balance sheet and financial statement. Plant location and plant layout including piping.

##### CIVIL ENGINEERING

##### PAPER-1

##### 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.

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First and Second Moment of area, Mass moment of Inertia, Static Friction, Inclined Plane and bearings, Kinematics and Kinetics, Kinematics In Cartesian and Polar Coordinates, motion under uniform and nonuniform acceleration, motion under gravity, Kinetics of particle: Momentum and Energy principles, D'Alembert's Principle, Collision of elastic bodies, rotation of rigid bodies, simple harmonic motion, Flywheel.

#### STRENGTH OF MATERIALS:

Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending, Shear Stress distribution across cross sections, Beams of uniform strength, Leaf Spring, Strain Energy in direct stress, bending & shear. Deflection of beams; Mecaulay's method, Mohr's Moment area method, Conjugate beam method, unit load method, Torsion of Shafts, Transmission of power, close coiled helical springs, Elastic stability of columns, Euler's Rankin's and Secant formulae. Principal Stresses and Strains in two dimensions, Mohr's Circle, Theories of Elastic Failure, Thin and Thick cylinder; Stresses due to internal and external pressure.- Lamé's equations.

#### STRUCTURAL ANALYSIS:

Castigliano's theorems I and II, Unit load method of consistent deformation applied to beams and pin jointed trusses. Slope-deflection, moment distribution, Kani's method of analysis and column Analogy 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 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.

Matrix methods of analysis: Force method and displacement method of analysis of indeterminate beams and rigid frames.

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 axis, 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 member, 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:

Concept of mix design, Reinforced Concrete: Working Stress and Limit State method of design-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, weirs, 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 nonuniform 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, Air vessels, 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, Flow duration curves and dependable flow. Storage and pondage, Pumped storage plants, Special features of mini, micro-hydel plants.

#### PART-D

#### 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 pressure, Rankin'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, Newmarks 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, piles 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

##### Part-A

#### 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 ferro-cement, 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:** Building components and their functions; Brick masonry: Bonds, jointing, Stone masonry, Design of Brick masonry walls as per I.S. codes, factors of safety, serviceability and strength requirements; plastering, pointing, Types of Floors & Roofs, Ventilators, Repairs in buildings, 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:

Standard and special types of equipment, Preventive maintenance and repair, factors affecting the selection of equipment, economical life, time and motion study, capital and maintenance cost.

**Concreting equipments:** Weigh batcher, mixer, vibration, batching plant, Concrete pump.

**Earth-work equipment:** Power shovel hoe, bulldozer, dumper, trailers, 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.

**New-work analysis:** CPM and PERT analysis, Float times, cashing of activities, contraction of network for cost optimization, up dating, cost analysis and resource allocation.

Elements of Engineering Economics, methods of appraisal, present worth, annual cost, benefit-cost, incremental analysis. Economy of scale and size. Choosing between alternatives including levels of investments, project profitability.

##### Part-B

#### SURVEY AND TRANSPORTATION ENGINEERING

**Survey:** Common methods of distance and angle measurements, plane Table survey, levelling traverse survey, triangulation survey, corrections, and adjustments, contouring, topographical map. Surveying instruments for above purposes Techeometry, Circular and transition curves, Principles of photogrammetry.

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

**Highway Engineering:** Principles of highway planning, Highway alignments, Geometrical design; Cross section, camber, superelevation, horizontal and vertical curves. Classification of roads: low cost roads, flexible pavements, rigid pavements, Design of pavements and their construction, evaluation of pavement failure and strengthening.

Drainage of roads: Surface and subsurface drainage.

**Traffic Engineering:** Forecasting techniques, origin and destination survey, highway capacity, Channelised and unchannelised Intersections, rotary design elements, markings, sign, signals, street lighting; Traffic surveys, Principle of highway financing.

##### 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 of permeability, confined and unconfined aquifers, aquifers, aquitards, radial flow into a well under confined and unconfined conditions, tube wells, pumping and recuperation 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, drain-age behind lining.

Water logging: causes and control, drain-age 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, Khosle'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 pipe 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.

Sewerage systems: Domestic and Industrial wastes, storm sewage-separate and combined systems, flow through sewers, design of sewers, sewer appurtenances, manholes, in lets, junctions, siphon, Plumbing in Public buildings.

**Sewage characterisation:** 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

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ill-effects.

**Environmental pollution:** Sustainable development. Radioactive wastes and disposal, Environmental impact assessment for thermal power plants, mines, river valley projects, Air pollution, Pollution control acts.

**FORESTRY  
PAPER-I  
SECTION A**

**1. Silviculture-General:**

**General Silviculture 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, poly-bags 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 lebeck, Albizzia procera, Anthocephalus Cadamba, Anogeissus, latifolia, Azadirachta indica, Bamboo spp, Butea monosperma, Cassia siamea, Casuarina equisetifolia, Cedrus deodara, Chukrasia tabularis, Dalbergia sisoo, Dipterocarpus spp, Emblica officinilis, Eucalyptus spp, Gmelina Arborea, Hardwickia binata, Lagerstroemia Lanceolata, Pinus roxburghii, Populus spp, Pterocarpus marsupium, Prosopis juliflora, Santalum album, Samecarpus anacardium, Shorea robusta, Salmalla malabaricum, Tectona grandis, Terminalis tomentosa, Tamarindus Indica.

**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 eco-system preservation including ecological balances through pest-predator relationships and (v) Providing opportunities for enhancing biodiversity, 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; people's participation.

**JFM- Principles, objectives, methodology, scope, benefits and role of NGOs.**

**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 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 micro-organisms in ameliorating soils; N and C cycles, VAM.

**Watershed Management:** Concepts of watershed; role of mini-forests and forest trees in overall resource management, forest hydrology, watershed development in respect of torrent control, river channel stabilization, avalanche and landslide controls, rehabilitation of degraded areas; hilly and mountain areas; 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 fodders.

**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 water shed 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 modelling.

**4. Surveying and Forest Engineering:**

**Forest Surveying:** 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 systems, 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 and 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 CO<sub>2</sub>, 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 analysis; 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 analysis 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; industrialisation 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.**

**GEOLOGY  
PAPER-I  
SECTION-A**

**(i) General Geology:**

The Solar System, meteorities, origin and interior of the earth, Radioactivity and age of earth; Volcanoes-causes and products, volcanic belts, Earthquakes-causes, effects, earthquake belts, seismicity of India, intensity and magnitude, seismographs, Island arcs, deep sea trenches and mid-ocean ridges, Continental drift-evidences and mechanics; sea-floor spreading, plate tectonics. Isostasy, orogeny and epeirogeny. Continents and oceans.

**(ii) Geomorphology and Remote Sensing:**

Basic concepts of geomorphology, Weathering and mass wasting, Landforms, slopes and drainage. Geomorphic cycles and their interpretation, Morphology and its relation to structures and lithology. Applications of geomorphology in mineral prospecting, civil engineering, hydrology and environmental studies. Geomorphology of Indian sub-continent. Aerial photographs and their interpretation-merits and limitations. The Electromagnetic Spectrum. Orbiting satellites and sensor systems. Indian Remote Sensing Satellites. Satellites data products, Applications of remote sensing in geology. The Geographic Information System and its applications. Global Positioning System.

**(iii) Structural geology:**

Principles of geologic mapping and map reading, projection diagrams, stress and strain ellipsoid and stress-strain relationships of elastic, plastic and viscous materials, Strain markers in deformed rocks, Behaviour of minerals and rocks under deformation conditions, Folds and faults classification and mechanics. Structural analysis of folds, foliations, lineations, joints and faults, unconformities, Superposed deformation, Timerelationship between crystallization and deformation. Introduction to petrofabrics.

**SECTION- B**

**(iv) Paleontology:**

Species definition and nomenclature. Megafossils and Microfossils. Modes of preservation of fossils, Different kinds of micro fossils. Application of microfossils in correlation, petroleum exploration, paleo-climatic and pale oceanographic studies, Morphology, geological history and evolutionary trend in Cephalopoda, Trilobita, Brachiopoda, Echi-noidea and Anthozoa, Stratigraphic utility of Ammonoidea, Trilobita and Graptoloidea, Evolutionary trend in Hominidae, Equidae and Probo-scidae. Siwalik fauna, Gondwana flora and its importance.

**(v) Stratigraphy and Geology of India:**

Classification of Stratigraphic sequences: Lithostratigraphic, biostratigraphic, chronostratigraphic and magnetostratigraphic and the interrelation-ships, Distribution and classification of Precambrian rocks of India, Study of stratigraphic distribution and lithology of Phanerozoic rocks of India with reference to fauna, flora and economic importance, Major boundary problems-Cambrian/Precambrian, Permian/Triassic, Cretaceous/Tertiary and Pliocene/ Pleistocene, Study of climatic conditions, paleogeography and igneous activity in the Indian subcontinent in the geological past, Tectonic framework of India. Evolution of the Himalayas.

**(vi) Hydrogeology and Engineering Geology:**

Hydrologic cycle and genetic classification of water. Movement of subsurface water, Springs, Porosity, permeability, hydraulic conductivity, transmissivity and storage coefficient,

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classification of aquifers. Water-bearing characteristics of rocks, Ground-water chemistry. Salt water intrusion, Types of wells. Drainage basin morphometry. Exploration for groundwater. Groundwater recharge, Problems and management of groundwater, Rainwater harvesting. Engineering properties of rocks. Geological Investigations for dams, tunnels and bridges, Rock as construction material. Alkali-aggregate reaction, Landslides causes, prevention and rehabilitation, Earthquake-resistant structures.

**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. Petrological microscope and accessories. Optical properties of common rock forming minerals, Pleochroism, extinction angle, double refraction birefringence, twinning and dispersion in minerals.

Physical and chemical characters of rock forming silicate mineral groups. Structural classification of silicates. Common minerals of igneous and metamorphic rocks. Minerals of the carbonate, phosphate, sulphide and halide groups.

**(ii) Igneous and Metamorphic Petrology** Generation and crystallisation of magma. Crystallisation of albite-anorthite, diopside-anorthite and diopside-wollastonite-silica systems, Reaction principle, Magmatic differentiation and assimilation, Petrogenetic significance of the textures and structures of igneous rocks. Petrography and petrogenesis of granite, syenite, diorite, basic and ultrabasic groups, charnockite, anorthosite and alkaline rocks, Carbonatites. Deccan volcanic province, Types and agents of metamorphism, Metamorphic grades and zones, Phase rule. Facies of regional and contact metamorphism, ACF and AKF diagrams Textures and structures of metamorphic rocks, Metamorphism of arenaceous, argillaceous and basic rocks, Minerals assemblages, Retrograde metamorphism, Metasomatism and granitisation, migmatites, granulite terrains of India.

**(iii) Sedimentology:**

Sedimentary rocks : Processes of formation, diagenesis and lithification, Properties of sediments, Clastic and nonclastic rocks-their classification petrography and depositional environment, Sedimentary facies and provenance. Sedimentary structures and their significance. Heavy minerals and their significance, Sedimentary basins of India.

**SECTION-B**

**(iv) Economic Geology**

Ore, ore minerals and gangue, tenor of ore, classification of ore deposits. Process of formation of minerals deposits, Controls of ore localisation. Ore textures and structures, Metallogenic epochs and provinces, Geology of the important Indian deposits of aluminium, chromium, copper, gold, iron, lead, zinc, manganese, titanium, uranium and thorium and industrial minerals, Deposits of coal and petroleum in India, National Mineral Policy, Conservation and utilization of mineral resources, Marine mineral resources and Law of Sea.

**(v) Mining Geology:**

Methods of prospecting-Geological, geophysical, geo-chemical and geo-botanical, Techniques of sampling. Estimation of reserves of ore, Methods of exploration and mining metallic ores. Industrial minerals and marine mineral resources, Mineral beneficiation and ore dressing.

**(vi) Geochemistry and Environmental Geology:**

Cosmic abundance of elements, Composition of the planets and meteorites, Structure and composition of earth and distribution of elements, Trace elements, Elements of crystal chemistry types of chemical bonds, coordination number, Isomorphism and polymorphism, Elementary thermodynamics.

Natural hazards-floods, landslides, coastal erosion, earthquakes and volcanic activity and mitigation, Environmental impact of urbanization, open cast mining, industrial and radioactive waste disposal, use of fertilizers, dumping of mine waste and fly-ash, 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, equivalences, congruences and similarity, reduction to canonical form, rank, orthogonal, symmetrical, skew symmetrical, unitary, hermitian, skew-hermitian forms- their eigenvalues. 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.

**Analytical 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, Clairaut'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, meta-centre, 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, sub-groups, 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.

**SECTION-B**

**Partial differential equations:**

Curves and surfaces in three dimensions, formulation of partial differentiation equations, solutions of equations of type  $dx/p=dy/q=dz/r$ ; orthogonal trajectories, Pfaffian differential equations; partial differential equation 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. Numerical solution of ordinary differential equations: Euler and Runge Kuttamethods, 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 from 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's equations, Hamilton equations, moment of inertia, motion of rigid bodies in two dimensions. Equation of continuity, Euler's equation 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 multi-cylinder 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 anisotropy, 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. Rotating discs. Shrink fits.

**3. Engineering Materials**

Basic concepts on structure of solids, crystalline materials, Defects in crystalline materials, Alloys and, binary phase diagrams, structure and properties of common engineering materials. Heat treatment of steels, plastics, Ceramics and composite. Materials, common applications of various materials.

**4. Manufacturing Science**

Merchant's force analysis, Taylor's tool life equation, machinability and machining economics, Rigid, small and flexible automation, NC, CNC. Recent machining methods-EDM, ECM and ultrasonic. Application of lasers and plasmas, analysis of forming processes. High energy rate forming Jigs, fixtures, tools and gauges, Inspection of length, position, profile and surface finish.

**5. MANUFACTURING MANAGEMENT**

Production Planning and Control, Forecasting-moving average exponential smoothing, Operations scheduling assembly line balancing. Product development, Breakeven analysis, Capacity planning, PERT and CPM, Control Operations: Inventory control-ABC analysis, EOQ model, Materials requirement planning, Job design, Job standards, work Measurement, Quality management- Quality control Operations Research: Linear programming-Graphical and Simplex methods, Transportation and assignment models, Single server queuing model. Value Engineering; Value analysis, for cost/value, Total quality management and forecasting techniques. Project management.

**6. ELEMENTS OF COMPUTATION**

Computer Organisation, Flow charting, Features of Common Computer Languages FORTRAN, d Base-III, Lotus 1-2-3, C and elementary programmings.

**PAPER-II**

**1. THERMODYNAMICS:**

Basic concept, Open and closed systems, Applications of Thermo-dynamic Laws., Gas equations, Clapeyron equation, Availability, Irreversibility and T ds relations.

**2. I.C. Engines:**

Fuels and Combustion: Spark Ignition and compression ignition engines, four stroke engine and two stroke engines, mechanical, thermal and volumetric efficiency, Heat balance.

Combustion process in S.I. and C.I. engines, pre-ignition detonation in S.I. engine Diesel

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knock in C.I. engine, Choice of engine fuels, Octane and Cetane ratings. Alternate fuels Carburation 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:

One and two dimensional heat conduction. Heat transfer from extended surfaces, heat transfer by forced and free convection, Heat exchangers, Fundamentals for diffusive and connective mass transfer, Radiation laws, heat exchange between black and non black surfaces, Network Analysis, Heat pump, refrigeration cycles and systems, Condensers, evaporators and expansion devices and controls, Properties and choice of refrigerant, Refrigeration Systems and components, psychometrics, comfort indices, cooling loading calculations, solar refrigeration.

### 4. TURBO-MACHINES AND POWER PLANTS:

Continuity, momentum and Energy Equations. Adiabatic and Isentropic flow, fanno lines, Rayleigh lines, Theory and design of axial flow turbines and compressors, Flow through turbo-machine blade, cascades, centrifugal compressor. Dimensional analysis and modelling. Selection of site for steam, hydro nuclear and stand-by power plants, Selection base and peak load power plants, Modern High Pressure, High duty boilers, Draft and dust removal equipment, Fuel and cooling water systems, heat balance, station and plant heat rates, operation and maintenance of various power plants, preventive maintenance, economics of power generation.

## 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, inertial and non-inertial frames, rotating frames, centrifugal and Coriolis forces; Foucault pendulum.

#### (b) System of particles

Constraints, degrees of freedom, generalised coordinates and momenta, 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 application to a decay process Minkowski diagram, four dimensional momentum vector. Covariance of equations of physics.

#### (b) Waves

Simple harmonic motion, damped oscillation forced oscillation and resonance, Beats. Stationary waves in a string. Pulses and wave packets. Phase and group velocities. Reflection and Refraction from Huygen's principle.

#### (c) Geometrical Optics

Laws of reflection and refraction from Fermat's principle. Matrix method in paraxial optic-thin lenses formula, nodal planes, system of two thin lenses, chromatic and spherical aberrations.

### 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

Production and detection of linearly and circularly polarised light. Double refraction, quarter wave plate, Optical activity, Principles of fibre optics attenuation; pulse dispersion in step index and parabolic index fibres; material dispersion, single mode fibres. Lasers-Einstein A and B coefficients; Ruby and He-Ne lasers. Characteristics of laser light-spatial and temporal coherence, Focussing of laser beams, Three-level scheme for laser operation.

## SECTION-B

### 4. Electricity and Magnetism

#### (a) Electrostatics and Magneto-statics

Laplace and Poisson equations in electrostatics and their applications. Energy of a system of charges, multiple expansion of scalar potential. Method of images and its applications, Potential and field due to a dipole, force and torque on a dipole in an external field. Dielectrics, polarisation, Solutions, to boundary-value problems-conducting and dielectric spheres in a uniform electric field. Magnetic shell, uniformly magnetised sphere, Ferromagnetic materials, hysteresis, energy loss.

#### (b) Current Electricity

Kirchhoff's laws and their applications, Biot-Savart law, Ampere's law, Faraday's law, Lenz' law. Self and mutual inductances. Mean and rms values in AC circuits, LR, CR and LCR circuits-series and parallel resonance, Quality factor, Principle of transformer.

### 5. Electromagnetic Theory & Black Body Radiation

#### (a) Electromagnetic Theory

Displacement current and Maxwell's equations Wave equations in vacuum, Poynting theorem, Vector and scalar potentials, Gauge invariance, Lorentz and Coulomb gauges, Electromagnetic field tensor, covariance of Maxwell's equations, Wave equations in isotropic dielectrics, reflection and refraction at the boundary of two dielectrics. Fresnel relations, Normal and anomalous dispersion, Rayleigh scattering.

#### (b) Blackbody radiation

Blackbody radiation and 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

Laws of thermodynamics, reversible and irreversible processes, entropy, Isothermal, adiabatic, isobaric, isochoric processes and entropy change, Otto and Diesel engines, Gibb's phase rule and chemical potential. Van der Waals equation of state of real gas, critical constants, Maxwell-Boltzmann distribution of molecular velocities, transport phenomena, equipartition and virial theorems, Dulong-Petit, Einstein, and Debye's theories of specific heat of solids. Maxwell relations and applications. Clausius-Clapeyron equation. Adiabatic demagnetisation, Joule-Kelvin effect and liquefaction of gases.

#### (b) Statistical Physics

Saha ionization formula, Bose-Einstein condensation, Thermodynamic behaviour of an ideal

Fermi gas, Chandrasekhar limit, elementary ideas about neutron stars and pulsars, Brownian motion as a random walk, diffusion process, Concept of negative temperatures.

## PAPER-II

### SECTION-A

**1. Quantum Mechanics:** Wave-particle duality, Schrodinger equation and expectation values. Uncertainty principle, Solutions of the one-dimensional Schrodinger equation free particle (Gaussian wave-packet), particle in a box, particle in a finite well, linear, harmonic oscillator, Reflection and transmission by a potential step and by a rectangular barrier, use of WKB formula for the life-time calculation in the alpha-decay problem.

### 2. Quantum Mechanics II & Atomic Physics

#### (a) Quantum Mechanics II

Particle in a three dimensional box, density of states, free electron theory of metals, The angular momentum problem, The hydrogen atom, The spin half problem and properties of Pauli spin matrices.

#### (b) Atomic Physics

Stern-Gerlach experiment, electron spin, fine structure of hydrogen atom, L-S coupling, J-J, coupling, Spectroscopic notation of atomic states, Zeeman effect, Frank-Condon principle and applications.

### 3. Molecular Physics

Elementary theory of rotational, vibrational and electronic spectra of diatomic molecules, Raman effect and molecular structure, Laser Raman spectroscopy importance of neutral hydrogen atom, molecular hydrogen and molecular hydrogen ion in astronomy Fluorescence and Phosphorescence, Elementary theory, and applications of NMR. Elementary ideas about Lamb shift and its significance.

## SECTION-B

### 4. Nuclear Physics

Basic nuclear properties-size, binding energy, angular momentum, parity, magnetic moment, Semi-empirical mass formula and applications, Mass parabolas, Ground state of deuteron magnetic moment and non-central forces, Meson theory of nuclear forces, Salient features of nuclear forces, Shell model of the nucleus-success and limitations, Violation of parity in beta decay, Gamma decay and internal conversion, Elementary ideas about Mossbauer spectroscopy, Q-value of nuclear reactions, Nuclear fission and fusion, energy production in stars, Nuclear reactors.

### 5. Particle Physics & Solid State Physics:

#### (a) Particle Physics

Classification of elementary particles and their interactions, Conservation laws, Quark structure of hadrons, Field quanta of electro-weak and strong Interactions, Elementary ideas about Unification of Forces, Physics of neutrinos.

#### (b) Solid State Physics

Cubic crystal structure, Band theory of solids-conductors, insulators and semiconductors, Elements of superconductivity, Meissner effect, Josephson junctions and applications, Elementary ideas about high temperature superconductivity.

### 6. Electronics

Intrinsic and extrinsic semiconductors-p-n-p and n-p-n transistors. Amplifiers and oscillators, Op-amps, FET, JFET and MOSFET, Digital electronics-Boolean Identities, De-Morgan's laws, Logic gates and truth tables, Simple logic circuits, Thermistors, solar cells, Fundamentals of microprocessors and digital computers.

## 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, completeness, 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, Bhattacharya'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, Kolmogorov's test for goodness of fit and its consistency, sign test and its optimality, Wilcoxon signed-ranks test and its consistency, Kolmogorov-Smirnov two-sample test, run test, Wilcoxon-Mann Whitney test and median test, their consistency and asymptotic normality.

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 theory, 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;  $D^2$  and Hotelling's  $T^2$  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 estimator. Non-negative variance estimation with reference to the Horvitz Thompson estimators, non-sampling errors, Warner's randomised response technique for sensitive characteristics. Fixed effects model (two-way classification) random and mixed effects models (two-way classification with equal number of observation per cell), CRD, RBD, LSD and their analysis; incomplete block designs, concepts of chronogonality 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.

**PAPER- II****I. Industrial Statistics**

Process and product control, general theory of control charts, different types of control charts for variables and attributes,  $\bar{X}$ ,  $R$ ,  $s$ ,  $p$ ,  $np$  and  $c$  charts, cumulative sum chart, V-mask, single, double, multiple and sequential sampling plans for attribute, OC, ASN, AQQ and ATI curves concepts of producer's and consumer's risks, AQL, LTPD and AOQL, sampling plans for variables, use of Dodge-Roming 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, method 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 queuing 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, Peashe's and Fisher's ideal Index numbers, chain-base index numbers, uses and limitations of index numbers, index number of wholesale prices, consumer price index number, index numbers of agricultural and industrial production, test 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 multi-collinearity, consequences and solutions of multi-collinearity, 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.

Method of standardisation of scales and tests, Z-scores, standard scores, T-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.

**ZOOLOGY****PAPER-I****Section-A****I. 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 Paramecium, 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) Nematelminthes: General features, life history and parasitic adaptation of Ascaris; nematelminths 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 (Hirundaria).

(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, Pila 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) Aves: Origin of birds; flight adaptation, migration.

(p) 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****I. Ecology:**

(a) Biosphere: Biogeochemical cycles, green-houses effect, ozone layer and its impact; ecological succession, biomes and ecotomes.

(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 (helminths) and vectors (ticks, mites, Tabanus, Stomoxys)

(d) Pests of sugar cane (Pyrrilla perpusiella), oil seed (Achaea Janata) and rice (Silophilus oryzae).

**IV. Biostatistics:**

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).

**PAPER-II****Section-A****I. Cell Biology:**

(a) Structure and function of cell and its organelles (nucleus, plasma membrane, mitochondria, Golgibodies, endoplasmic reticulum ribosomes 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, cistron concept; genetics of blood groups.

(d) Mutations and mutagenesis; radiation and chemical.

(e) Cloning technology, plasmids and cosmids as vectors, transgenics, transposons, DNA sequence cloning and whole animal cloning (Principles and methodology).

(f) Regulation and gene expression in pro-and eu-karyotes.

(g) Signal transduction; pedigree-analysis; congenital diseases in man.

(h) Human genome mapping; DNA fingerprinting.

**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, aminoacids, 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 co-enzymes.

(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 morphogon; 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.

**Secretary**