



JAMMU AND KASHMIR PUBLIC SERVICE COMMISSION

RESHAM GHAR COLONY, BAKSHI NAGAR, JAMMU - 180001

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Subject: Filling up of the posts of Assistant Engineers (Civil) in Jal Shakti Department

Reference: JSD-HRM06/1/2022-A-JSD(CC-127804 dated 30.11.2022).

Notification No. : 28 - PSC (DR-P) OF 2022 Dated: 26 -12-2022

Applications through online mode, are invited from the eligible candidates who are domiciles in the Union Territory of Jammu & Kashmir, possessing the academic/Professional qualification and age, for the posts of Assistant Engineer (Civil), Jal Shakti Department, details of which are given in the following succeeding, in terms of the Jammu & Kashmir "Engineering (Gazetted) Service Recruitment Rules, 1978 notified vide SRO 297 of 2006 dated 14-09-2006, and, the Jammu & Kashmir Public Service Commission (Business & Procedure) Rules, 2021:-

IMPORTANT

- The Application Form together with instructions for filling up the Application Forms will be available at the website of the Commission from **29.12.2022**.
- Candidates are advised to go through the instructions and all the eligibility conditions prescribed for the post before filing the online Application Form.
- Last date for filing of online Application complete in all respects along with the requisite fee (online mode only) is **28.01.2023**.
- The last date for receipt of online applications provided in the notification shall be the cut-off date for determining the eligibility as regards acquisition of Domicile Certificates and educational and professional qualifications.
- The minimum and maximum age will however be reckoned with reference to **1st January, 2022**.
- Candidates can edit some of the fields in their online application form from **29.01.2023 (12:00am) to 31.01.2023 (11:59 pm) (3 days)**. Instructions in this regard will be made available on the website.
- Candidates are not required to submit a hard copy or any other documents to the Commission.
- Candidates will not be required to submit a hard copy of the online application form and the mandatory/requisite documents.
- In case the mediatory prescribed/requisite documents are not uploaded the online application form, the application form/candidature of the applicant is liable to be rejected.
- Candidates are advised in their own interest to submit online applications much before the closing date and not to wait till the last date to avoid the possibility of disconnection/inability to pay fee or failure to login to the online application portal on account of heavy load on the website during the closing days.
- Tentative date of examination is **4th week of April, 2023**.

2. **Name of post, pay scale and categories wise break-up:-**

Item No.	Name of the Discipline	OM	RBA	SC	ST	ALC/ IB	SoC	PSP	EWS	Total
01	Assistant Engineer (Civil) Jal Shakti Department Level-8A(50700-160600)	27	05	04	05	02	01	02	04	50

Prescribed Qualification

Designation	Qualification
Assistant Engineer (Civil) Jal Shakti Department	Bachelor's Degree in the relevant branch of Engineering (Civil Engineering) or AMIE Section (A&B) India in the appropriate branch of Engineering.

3. **Age as on 1st January 2022**

The requirement of age for candidates belonging to Open Merit (OM) & various Reserved Categories is as follows:-

S.NO	Category	Age limit	Not born after	Not born before
1	OM	40	01.01.2004	01.01.1982
2	RBA/SC/ST/ALC-IB/SoC/EWS/PSP	43	01.01.2004	01.01.1979
3	PHC	42	01.01.2004	01.01.1980
4	In service candidate/Government	40	01.01.2004	01.01.1982

4. **Horizontal Reservation**

Two vacancies have been reserved for persons with Benchmark disability, as per Government Order No.59-JK(SWD) of 2021, dated: 15-04-2021 issued by the Social Welfare Department..

Note: The Horizontal reservation for physically handicapped persons to the extent of 4% means that the reservation would cut across the vertical reservation and the persons selected shall have to be placed in the appropriate category by making necessary adjustments.

5. **Reservation**

- A candidate seeking his/her consideration under Reserved Categories must ensure that he/she possesses a valid requisite Category certificate and on the cut-off date.
- The candidature of the candidates will be provisional till the genuineness of the reserved category certificate is verified by the Appointing Authority.
- Candidates may note that in case a claim for reservation is made on the basis of false/fake/fraudulent certificate, he/she shall be debarred from the examination(s) conducted by the J&K Public Service Commission, in addition to any other penal action as may be deemed appropriate.

6. **Domicile**

The candidate should be a Domicile of the Union Territory of Jammu & Kashmir. The candidate must possess the Domicile Certificate issued by the Competent Authority in the prescribed format as on the last date prescribed for submission of online application form.

7.

Centre of Examination

- I. The examination will be held at Srinagar & Jammu centres. All the candidates shall indicate the option for examination centre as indicated above.
- II. The allotment of centres shall be at sole discretion of the Commission and once a centre is allotted to a candidate, request for a change of centre will not be entertained.
- III. Information about the Examination indicating the time table and Centre of Examination for the candidates will be uploaded on the websites of the Commission about two weeks before the date of examination. If any candidate does not find his/her Roll Number on the website of the Commission, one week before the date of examination, he/she must immediately contact the Commission's Office at Srinagar/Jammu, with proof of having submitted his/her application. Failure to do so will deprive him/her of any claim for consideration.
- IV. Candidate must submit his/her online application form, Email ID and Mobile Number along with his/her Name, Date of Birth and Name of the Examination, while addressing any communication to the Commission. Communication from the candidates not furnishing these particulars shall not be entertained.
- V. Admit Cards will be available for downloading about two weeks before the date of examination on the official website of the Commission i.e. jkpsc.nic.in. Candidate must bring printout of the Admit Card/Roll Number Slip to the Examination Hall.
- VI. For securing entry into the centre of examination, in addition to the Admit Card/roll Number Slip, it is mandatory to carry at least two passport size recent color photographs (not taken earlier than 01.01.2022) and any of the original valid Photo-Id proof such as:
 - i. Aadhar Card/ E-Aadhar,
 - ii. Voter's ID Card,
 - iii. Driving License,
 - iv. PAN Card,
 - v. Passport,
 - vi. School /College/University I- Card
 - vii. Employer ID Card.

08. The Selection shall be made in accordance with the provisions of Rule 43(ii) of Jammu and Kashmir Public Service Commission (Business & Procedure) Rule, 2021, reproduced as under :-

A	Written Examination		68 points	
B	Performance in the interview/Viva Voce test. The candidate shall be asked to deliver a 5 minute demonstration/lecture on a given topic from the relevant subject to demonstrate his/her domain knowledge/skills and will be assessed and evaluated by the subject experts and the Members of the Commission in the Selection Committee/Interview Board.		25 points	
C	Weightage for Academic Merit/ Higher Qualifications in the relevant subject		Upto a Maximum of 04 points	
	a	Where Bachelor's degree is prescribed as the minimum qualification	Upto a Minimum of 04 points	
		(i) One year Post Graduate Diploma in the relevant subject (on pro-rata basis)	02 points	Maximum 4 points
		(ii) Masters/Post Graduate degree in the relevant subject (on pro-rata basis)	04 points	
D	Distinction in Sports (Certified by Secretary, J&K Sports Council to be an outstanding Sports Person in terms of J&K (Appointment of Outstanding Sports Persons) Rules, 2022		01 point	
E	Distinction in NCC activities (Holder of Grade "C" Certificate)		01 points	
F	Special Attributes			
	(i)	Gold Medal for overall first position in the prescribed qualification	01 point	
G	Total (A to F)		100 points	

09. **Scheme of Selection / Examination**

- **The pattern of Examination shall comprise the following:**

(A) **Written Examination**

- i. The written examination will be an objective type Multiple Choice Question (MCQ) paper of two hours duration and having minimum 120 questions.
- ii. There will be negative marking for incorrect answers (as detailed below) for all questions:
 - a. There are four alternatives for the answers to every question. For each question for which a wrong answer has been given by the candidate, one fourth (0.25) of the marks assigned to that question will be deducted as penalty.
 - b. If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answer happen to be correct and there will be same penalty as above for that question.
 - c. If a question is left blank i.e. no answer is given by the candidate, there will be no penalty for that question
- iii. The written exam will carry Sixty eight (68) points. The marks obtained in the written examination shall be taken into account on pro-rata basis for determining the final merit list
- iv. The Syllabus for the written examination is enclosed as annexure "A" and also available on the website of the Commission (www.jkpsc.nic.in).

(B) Interview/ Viva Voce

On the basis of the marks obtained by the candidates in the written examination, an interview/viva voce test will be conducted. The number of candidates called for interview/ viva voce test shall be restricted, as far as practicable, to a minimum of three times the number of vacancies in order of merit. The interview/ viva-voce will have 25 points.

10. Provision of Compensatory Time and Assistance of Scribe

On request of a visually impaired (Blind) or any other candidate who is handicapped to the extent that he/she is not able to write, the candidate shall be provided assistance of an amanuensis (Scribe) on production of a Disability Certificate issued by the Medical Board constituted by the Government consisting of CMO of the District and at least two Medical Specialists nominated by the concerned Director, Health Services (with atleast one specialist from the field concerned department). After verifying the genuineness of the certificate/satisfying itself, the Commission may provide services of Scribe to the candidate on the day of examination. The scribe should have one qualification down than the requirement for the post applied for by the candidate(s) and further should be from an academic stream different from that stipulated for the post. The scribe shall be paid remuneration charges equivalent to the Invigilator.

Provided the concerned Supervisor shall ensure that the scribe provided to the candidate shall not extend any type of help to the candidate in solving the questions. Blind candidates will be allowed an extra time of 10 minutes per hour.

11. Requisite Fee

After successful submission of the online application form, candidate will be required to deposit requisite fee through online mode. The amount of fee to be paid is given below:

General Category	=	Rs.1000.00
Reserved Categories	=	Rs.500.00
PHC Candidates	=	Nil.

Note:

- i. The application Form submitted without deposition of the fee, which gets substantiated through reflection of the same on the application form, such application form shall be treated as incomplete and candidature shall be deemed

- to have been rejected without any notice. No representation against such rejection shall be entertained.
- ii. Submission of multiple applications by way of prefixing Mr/Ms or through generation of multiple User ID's or any other mode, followed by either non-payment of fee particulars or fee particulars (TID) of one application (RID) being mentioned against another application with a different RID would lead to rejection of the online application. The applicants who are submitting multiple applications should note that only the applications with higher Registration ID (RID) number shall be entertained by the Commission and fee paid against one RID shall not be adjusted against any other RID number. Besides a strict disciplinary action shall be taken including the cancellation of candidature and debarment for future examinations of J&K PSC will be taken against such applicants.

12- Documents to be uploaded:-

While filling the online application form the applicants are requested to upload the documents as per details given below:-

(a) Documents (Mandatory):-

1. Date of birth certificate (secondary School/Matric Certificate)
2. Domicile Certificate of the UT of J&K.
3. Bachelor's Degree alongwith consolidated Marks Card (s) upto 05 lvs.

(b) Documents (Mandatory if claiming benefit under that category):-

1. Category Certificate. 01 leaf
2. In-service certificate signed by HOD

13. The necessary instructions regarding filling up of online applications are given herein below:

- a. Candidates are required to apply online through the website of the Commission i.e <http://www.jkpsc.nic.in>. No other means/ mode of application shall be accepted.
- b. Candidates are first required to go to the JK PSC website www.jkpsc.nic.in and click on the link "One Time Registration" or click on Login menu if you have already created your profile with the JK PSC.
- c. After logging into your account, candidates are required to fill all the requisite fields of One Time Registration (OTR) i.e. personal information, contact information & educational qualification, service details etc.
- d. The candidate shall also be required to upload the image of date stamped recent passport size color photograph and signature. The photograph should not be taken earlier than 01.01.2022.
- e. Size of the photograph (passport size) and signature must be between 10kB to 20kB in *.jpeg or *.jpg only.
- f. After successful submission of all the details in your OTR account, check the eligibility conditions as mentioned in the advertisement notification before applying for the post.
- g. Click on the "show examination" as shown against the respective post/examination you want to apply.
- h. On Clicking on the "show examination" a window will appear on your computer screen. Select the month of the advertisement notification for which you want to apply, a link(s) for the post(s) will appear on the computer screen.
- i. An "APPLY" button is shown against the respective post and the candidates will click on the APPLY button against the post he/she is eligible.
- j. On clicking "APPLY" button, an instruction window will appear. Candidates should read instructions carefully before clicking on "APPLY" button at the bottom of the webpage.
- k. On clicking "APPLY" button, the system will display all facts/particulars that a candidate may have mentioned while filling up the necessary fields of his/her

OTR account. Candidate shall fill up the remaining required fields in the application form and accept the declaration thereof.

- l. Once the candidate is satisfied *about the correctness* of the filled in details, then, he or she may click on "SUBMIT" button to finally push the data into server with successful submission report.
- m. On successful submission of the basic details, the candidates will be required to pay the online fee and uploading of the documents, for final submission of the online application form.
- n. Candidates can pay the requisite fee through online mode in the "SUBMITTED APPLICATIONS" menu in your account.
- o. After successful payment of the fee, the fee status will get reflected on the Online Application form. Candidates can check the fee status by clicking on the **Print Application Button** in the submitted Applications menu in your JKPSC account. In case the payment status shows either "not submitted or under processing or status has not been reflected on your submitted application form", candidates(s) are advised to contact the JKPSC office at Solina Srinagar/Resham Ghar Colony Jammu immediately for clarification. Further where the online fee is paid through other service providers the candidate must ensure that not only the amount of fee is debited from his/service provider's Account but also credited into the official account of JKPSC.
- p. The candidate would be able get the printout of his/her submitted application only after the payment of the requisite fee and uploading of requisite documents viz *Date of Birth Certificate, Degree Certificate, Category Certificate and Domicile Certificate*.
- q. The JKPSC will not undertake detailed scrutiny of applications for the eligibility and other aspects at the time of Preliminary examination and therefore, candidature will be accepted only provisionally. The candidates are advised to go through the requirements of educational qualification, age, etc and satisfy themselves that they are eligible for the post(s). Copies of supporting documents will be sought at the time of document verification. When scrutiny is under taken, if any claim if made in the application is not found/substantiated by proof, the candidature will be cancelled and the Commission's decision shall be final and binding.
- r. Please note that the above procedure is the only valid procedure for applying. No other mode of application or incomplete steps would be accepted and such applications would be rejected.

14. Editing of the online application form

Candidates who have successfully submitted the online application form along with requisite fee will be allowed to edit some of the fields in their submitted online application form within three days after the cut-of date i.e. on **29.01.2023 (12:00AM) upto 31.01.2023 (11:59PM)**. Detailed instruction in this regard will be made available on the website.

15. Action against candidates found guilty of misconduct

Candidates are advised that they should not furnish any particulars that are false or suppress any material information.

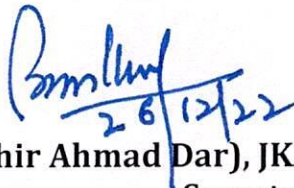
A candidate who is, or has been, declared by the Commission, to be guilty of:

- i. obtaining by wrongful support of his/her candidature by any means, or
- ii. impersonating, or
- iii. procuring impersonation by any person, or
- iv. submitting fabricated documents or documents which have been tampered with or
- v. making statements which are incorrect, or false or suppressing material information, or
- vi. resorting to any other irregular or improper means in connection with his/her candidature for the selection, or

- vii. using unfair means during the test, or
- viii. writing irrelevant matter including obscene language or pornographic matter , in the script(s), or
- ix. misbehaving in any other manner in the examination hall, or
- x. harassing or doing bodily harm to the staff employed by the Commission for the conduct of their test, or
- xi. attempting to commit or , as the case may be, abetting the Commission of all or any of the acts specified in the foregoing clauses may, in addition to rendering himself/herself liable to criminal prosecution.

shall be liable;

- a. to be disqualified by the Commission from selection for which he/she is a candidate , and/or
- b. to be debarred either permanently or for a specified period:-
 - i. By the Commission from any examination or selection held by them.
 - ii. By the Union Territory Government from any employment under them, and
- c. if he/she is already in service under Government, disciplinary action can be taken against him/her under the appropriate rules.


(Bashir Ahmad Dar), JKAS
Secretary
J&K Public Service Commission

No.PSC/DR/A.E/Civil/JSD/2022

Dated: 26.12.2022

Copy to the: -

1. Principal Secretary to Government, Jal Shakti Department Civil Secretariat, Jammu
2. Deputy Secretary/Under Secretary (DR), J&K Public Service Commission for information.
3. P.S. to Chairman, J&K Public Service Commission for information of the Hon'ble Chairman.
4. P.S. to Member _____, J&K PSC for information of Hon'ble Member.
5. In charge website, J&K Public Service Commission for uploading of the Notification on the website.
6. In charge Camp Office, Srinagar for pasting the notice on the notice board.
7. Notice Board, J&K Public Service Commission, Srinagar/Jammu.
8. Stock file/Main file.

ANNEXURE "A"
SYLLABUS FOR WRITTEN TEST FOR THE POST OF AE (CIVIL)

1. Engineering Mechanics, Strength of Materials and Structural Analysis.

1.1 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 free body diagram, conditions of equilibrium, Principle of virtual work, equivalent force system.

First and Second Moment of area, Mass moment of Inertia.

Static Friction. Kinematics and Kinetics:

Kinematics in cartesian Co-ordinates, motion under uniform and non-uniform acceleration, motion under gravity. Kinetics of particle : Momentum and Energy principles, collision of elastic bodies, rotation of rigid bodies.

1.2 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.

Deflection of beams: Mecaulay's method, Mohr's Moment area method, Conjugate beam method, unit load method. Torsion of Shafts, Elastic stability of columns, Euler's, Rankine's and Secant formulae.

1.3 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.

Rolling loads and Influences lines : Influences lines for Shear Force and Bending moment at a section of a beam. Criteria for maximum shear force and bending Moment in beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses.

Arches : Three hinged, two hinged and fixed arches, rib shortening and temperature effects.

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 Principal axes, calculation of bending stresses.

2. Design of Structures : Steel, Concrete and Masonry Structures.

2.1 Structural Steel Design :

Structural steel : Factors of safety and load factors. Riveted, bolted and welded joints and connections. Design of tension and compression members, beams of built up section, riveted and welded plate girders, gantry girders, stanchions with battens and lacings.

2.2 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, staircase slabs, simple and continuous beams of rectangular, T and L sections. Compression members under direct load with or without eccentricity.

Cantilever and Counter fort 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

3. Fluid Mechanics, Open Channel Flow and Hydraulic Machines :

3.1 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.

Continuity, momentum, energy equation, Navier Stokes equation, Euler's equation of motion, application to fluid flow problems, pipe flow, sluice gates, weirs.

3.2 Dimensional Analysis and Similitude:

Buckingham's Pi-theorem, dimensionless parameters.

3.3 Laminar Flow :

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

3.4 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.

3.5 Open Channel Flow :

Uniform and non-uniform flows, momentum and energy correction factors, specific energy and specific force, critical depth, rapidly varied flow, hydraulic jump, gradually varied flow, classification of surface profiles, control section, step method of integration of varied flow equation.

3.6 Hydraulic Machines and Hydropower :

Hydraulic turbines, types classification, Choice of turbines performance parameters, controls, characteristics, specific speed.

Principles of hydropower development.

4. Geotechnical Engineering :

Soil Type and Structure—gradation and particle size distribution—consistency limits.

Water in soil—capillary and structural—effective stress and pore water pressure—permeability concept—field and laboratory determination of permeability—Seepage pressure—quick sand conditions—Shear strength determination— Mohr Coulomb concept.

Compaction of soil—Laboratory and field test.

Compressibility and consolidation concept— consolidation theory—consolidation settlement analysis.

Earth pressure theory and analysis for retaining walls, Application for sheet piles and Braced excavation.

Bearing capacity of soil—approaches for analysis- Filed tests—settlement analysis—stability of slope of earth walk. Subsurface exploration of soils—methods

Foundation—Type and selection criteria for foundation of structures—Design criteria for foundation—Analysis of distribution of stress for footings and pile—pile group action—pile load test.

Ground improvement techniques.

5. Construction Technology, Equipment, Planning and Management

5.1 Construction Technology

Engineering Materials :

Physical properties of construction materials with respect to their use in construction—Stones, Bricks and Tiles; Lime, Cement, different types of Mortars and Concrete.

Physical properties of construction materials with respect to their use in construction—
 Stones, Bricks and Tiles; Lime, Cement, different types of Mortars and Concrete.
 Specific use of ferro cement, fibre reinforced C. C., High strength concrete.
 Timber; Properties defects—common preservation treatments.
 Use and selection of materials for specific use like Low Cost Housing, Mass Housing,
 High Rise Buildings.

5.2 Construction :

Masonry principles using Brick, stone, Blocks— construction detailing and strength characteristics.
 Types of plastering, pointing, flooring, roofing and construction features.
 Common repairs in buildings.
 Principle of functional planning of building for residents and specific use—Building code provisions.
 Basic principles of detailed and approximate estimating—specification writing and rate analysis-principles of valuation of real property.
 Machinery for earthwork, concreting and their specific uses—Factors affecting selection of equipments—operating cost of equipments.

5.3 CONSTRUCTION PLANNING AND MANAGEMENT :

Construction activity—schedules—organization for construction industry—Quality assurance principles.
 Use Basic principle of network—analysis in form of CPM and PERT—their use in construction monitoring, Cost optimization and resource allocation.
 Basic principles of Economic analysis and methods.
 Project profitability—Basic principles of Boot approach to financial planning-simple toll fixation criterions.

6. Surveying and Transportation Engineering

6.1 Surveying : Common methods and instruments for distance and angle measurement for CE work—their use in plane table, traverse survey, levelling work, triangulation, contouring and topographical map.

Basic principles of photogrammetry and remote sensing.

6.2 Railways Engineering : Permanent way— components, types and their function-
 Functions and Design constituents of turn and crossing— Necessity of geometric design of track—Design of station and yards.

6.3 Highway Engineering :

Principles of Highway alignments—classification and geometrical design elements and standards for Roads.

Pavement structure for flexible and rigid pavements—Design principles and methodology of pavements.

Typical construction methods and standards of materials for stabilized soil, WBM, Bituminous works and CC roads.

Surface and sub-surface drainage arrangements for roads—culvert structures.

Pavement distresses and strengthening by overlays.

Traffic surveys and their application in traffic planning—Typical design features for channelized, intersection rotary etc.—signal designs—standard Traffic signs and markings.

7. Hydrology, Water Resources and Engineering :

7.1 Hydrology :

Hydrological cycle, precipitation, evaporation, transpiration, infiltration, overland flow, hydrograph, flood frequency analyses, flood routing through a reservoir, channel flow routing—Muskingam method.

7.2 Ground Water flow :

Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquifers, aquitards, radial flow into a well under confined and unconfined conditions.

7.3 Water Resources Engineering :

Ground and surface water resources, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation.

7.4. Irrigation Engineering :

- (i) Water requirements of crops : consumptive use, duty and delta, irrigation methods and their efficiencies.
- (ii) 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.
- (iii) Water logging : causes and control, salinity.
- (iv) Canal structures : Design of head regulators, canal falls, aqueducts, metering flumes and canal outlets.
- (v) Diversion head work : Principles and design of weirs on permeable and impermeable foundation, Khosla's theory, energy dissipation.
- (vi) Storage works : Types of dams, design, principles of rigid gravity stability analysis.
- (vii) Spillways : Spillway types, energy dissipation.
- (viii) River training : Objectives of river training, methods of river training.

8. Environmental Engineering

8.1 Water Supply :

Predicting demand for water, impurities of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.

8.2 Intake of Water :

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

8.3 Sewerage Systems :

Domestic and industrial wastes, store sewage— separate and combined systems, flow through sewers, design of sewers.

8.4 Sewage Characterisation :

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

8.5 Sewage Treatment :

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

8.6 Solid waste :

Collection and disposal in rural and urban contexts, management of long-term ill-effects.

9. Environmental pollution :

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