



## ODISHA PUBLIC SERVICE COMMISSION

### ADVERTISEMENT NO. 03 OF 2022-23

Recruitment to the post of Assistant Agriculture Engineer in Class-II (Group-B) of Odisha Agricultural Engineering Service, under the Department of Agriculture & Farmers' Empowerment.

WEBSITE - <http://opsc.gov.in>

Online applications are invited from the prospective candidates through the pro forma application to be made available on the Website of the Commission (<http://opsc.gov.in>). The link for registration /re- registration shall be available from 12.07.2022 to 12.08.2022 (Note: 12.08.2022 is the last date for submission of Registered Online Application) for recruitment to **102 (One Hundred Two)** posts of Assistant Agriculture Engineer in Class-II (Group-B) of Odisha Agricultural Engineering Service (Methods of Recruitment and Conditions of Service) Rules, 2018 under Department of Agriculture & Farmer's Empowerment, in the scale of pay of Rs.44,900/- in Level-10, Cell-1 of Pay Matrix of ORSP Rule, 2017 (PB-2, Rs.9,300-34,800/- with Grade pay of Rs.4600/- under ORSP Rules, 2008), with usual Dearness and other Allowances as may be sanctioned by the Government of Odisha from time to time. The posts are permanent and likely to continue.

2. **Vacancy Position:** As per requisition filed by the Agriculture & Farmer's Empowerment Department of Government of Odisha, the vacancy positions are given below:

Sl. No.	Category	No of Vacancies
1	2	3
1	UR	72 (24-w)
2	SEBC	04 (01-w)
3	SC	08 (03-w)
4	ST	18 (06-w)
<b>Total</b>		<b>102 (34-w)</b>

Out of the total 102 (34-w) vacancies, **03** posts are reserved for **Ex-Servicemen**, **04(01-w)** posts are reserved for **Persons with Disabilities (whose permanent disability is 40% and more)** having **Locomotor Disability (03 posts)** and **HI (01post)** with physical requirement and functional classification mentioned below & **01(one)** post is reserved for **Sports Persons**. Candidates belonging to the categories of Ex-Servicemen, PWD & Sports person shall be adjusted against the categories to which they belong.

**NOTE:-** The Physical requirement and Functional Classification of the PWD reservation vacancy for the above post, as specified in G.A. Department Resolution No. 34450 dated 03.12.2013 and SSEPD Department letter No. 7140 dated 05.09.2017 are mentioned below:-

No of Post reserved for PWD	Physical Requirements	Categories of disabled suitable for the job
i)OL- 01	<b>S, ST, W, BN, MF, SE, RW</b> <b>Note:-S</b> -work performed by sitting (on bench or chair), <b>ST</b> -work performed by standing, <b>W</b> -work performed by walking, <b>BN</b> -work performed by bending, <b>MF</b> -work performed by manipulating (with fingers), <b>SE</b> -work performed by seeing, <b>RW</b> -work performed by reading and writing.	<b>OL, OA, HI, BL(MNR)</b>
ii)OA- 01		<b>Note:- OL</b> -one leg affected (R and/or L), <b>OA</b> -one arm affected (R or L)-
iii)BL(MNR)- 01		(a)impaired reach;(b)weakness of grip;(c)ataxia, <b>HI</b> -Partially deaf (with suitable aid), <b>BL(MNR)</b> -both legs affected but not arms (Mobility not be restricted).
iv)HI- 01		
Total- 04		

N.B.- (1) Out of 4% (four percent) reservation for Persons with Disabilities, 1% (one percent) reservation shall be for women with disabilities.

P.T.O.

**NOTE:-**

a) In case of non-availability of eligible/suitable Women candidates belonging to the respective categories, the unfilled vacancies of that category shall be filled up by eligible or suitable male candidate(s) of the same category.

b) Exchange of reservation between Scheduled Caste and Scheduled Tribe will not be considered in the non-availability of eligible and suitable S.C. /S.T. candidates.

c) The number of vacancies to be filled up on the basis of this recruitment is subject to change by the Government without notice, depending upon the exigencies of public service at the discretion of the State Government.

**3. AGE:** A candidate must have attained the age of **21(twenty one)** years and must not be above the age of **38 (Thirty eight)** years as on the **1<sup>st</sup> day of January 2022** i.e. he/she must have been born **not earlier than 2<sup>nd</sup> January 1984** and **not later than 1<sup>st</sup> January 2001**.

The upper age limit prescribed above shall be relax-able up to **05 (five)** years for candidates belonging to the categories of Socially and Educationally Backward Classes (S.E.B.C.), Scheduled Castes (S.C.), Scheduled Tribes (S.T.), Women & Ex-servicemen and **10 (Ten)** years for candidates belonging to PWD category, whose **permanent disability is 40% and more**.

PWD candidates belonging to SEBC, SC and ST categories are eligible for cumulative age relaxation benefit of **15 (Fifteen)** years.

Provided that a person who comes under more than one category mentioned above shall be eligible for only one age relaxation benefit which shall be considered most beneficial to them.

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

Date of birth entered in the High School Certificate or equivalent certificate issued by the concerned Board/Council will only be accepted by the Commission.

**4. EDUCATIONAL QUALIFICATION:**

A candidate must have possessed a **Degree in Agriculture Engineering** from any University or Institution recognized by any State Government or the Government of India.

**5. METHOD OF SELECTION:**

(a) The selection of candidates for recruitment to the posts of Assistant Agriculture Engineer shall be made on the basis of **Written Test** and **Viva Voce test**.

i. Written Test (MCQ):- Shall be of 200 (two hundred) Marks consisting of two papers with 100 marks each (each question shall carrying one mark). The examination shall be of 2 hours duration.

ii. There shall be **negative marking** for wrong answers with a **deduction of 0.25 marks** for every wrong answer.

iii. **Viva Voce test** shall consist of 25 (**twenty five**) marks.

(b) The detailed syllabus for the examination (Two papers) is at **Annexure-A**.

(c) The Commission shall short-list the candidates to be called for V.V. test to a reasonable number taking into consideration the marks secured in the written test.

(d) The Commission shall prepare a list of successful candidates in order of merit on the basis of written test and interview, which shall be equal to the number category wise vacancies advertised.

(e) If two or more candidates obtain equal marks, the order of merit shall be determined in accordance with the highest mark secured by such Candidates in Written Examination and should also marks secured by them in Written Examination be equal, the order of merit shall be determined in accordance with age, i.e. the candidates older in age shall be assigned higher position.

**6. PLACE OF EXAMINATION**

The written examination for the post of Assistant Agriculture Engineer shall be held at Cuttack. The programme of the examination shall be notified well in advance.

**7. OTHER ELIGIBILITY CONDITIONS:**

- (i) The candidate must be a citizen of India;
- (ii) The candidate must be able to read, write and speak Odia; and have –
  - (a) passed Middle English School examination with Odia as a language subject; or
  - (b) passed H.S.C. or equivalent examination with Odia as medium of examination in non-language subject; or
  - (c) passed in Odia as language subject in the final examination of Class – VII from a school or educational institution recognized by the Government of Odisha or the Central Government; or
  - (d) passed a test in Odia in Middle English School standard conducted by the School & Mass Education Department of Government of Odisha/ Board of Secondary Education, Odisha.
- (iii) A candidate, who has more than one spouse living, will not be eligible for appointment unless the State Government has exempted his/her case from operation of this limitation for any good and sufficient reasons;
- (iv) Government servants, whether temporary or permanent, are eligible to apply provided that they possess the requisite qualification and are within the prescribed age-limit as provided under Para-3 & Para-4 of the Advertisement. They must inform their respective Heads of the Office in writing regarding submission of their application for this recruitment and furnish "No Objection Certificate" during document verification.
- (v) If a candidate has at any time, been debarred for a certain period/chance(s) by the Odisha Public Service Commission or other State Public Service Commission or U.P.S.C. from appearing at any examination / viva voce test, he/she **will not be eligible** for such recruitment for that specified period / chance(s);
- (vi) **Only those candidates, who possess the requisite qualifications, are within the prescribed age limit and fulfill other eligibility conditions etc. by the closing date for submission of registered online application form, will be considered eligible;**
- (vii) A candidate who claims change in his/her name after having passed the H.S.C. examination, is required to furnish copy of publication of the changed name in the local leading daily newspaper as well as copy of notification in the Gazette in support of his/her change of name;
- (viii) Every candidate selected for appointment shall be examined by the Medical Board. A candidate, who does not satisfy the requirement after medical examination, shall not be appointed;
- (ix) Every person appointed to the service shall be on probation for a period of 02(two) years with effect from the date of joining in the post.

**8. IMPORTANT POINTS:**

- (i) **Online applications submitted to OPSC, if found to be incomplete in any respect, are liable for rejection without entertaining any correspondence with the applicants on that score;**
- (ii) **Admission to Written Examination/ Viva Voce test will be provisional. If on verification at any stage before or after the Examination it is found that a candidate does not fulfil all the eligibility conditions, his/her candidature will be liable to rejection. Decision of the Commission in regard to eligibility or otherwise of candidate shall be final;**
- (iii) This advertisement should not be construed as binding on the Government to make appointment;
- (iv) **Concessions meant for S.E.B.C., S.C. & S.T. by Birth are admissible to the Socially and Economically Backward Classes, Scheduled Castes & Scheduled Tribes of Odisha only;**
- (v) Any misrepresentation or suppression of information by the candidate in the application form will result in cancellation of his/her candidature or penalty, as decided by the Commission shall be imposed on the candidate;

**9. CERTIFICATES / DOCUMENTS TO BE ATTACHED:**

Candidates who will qualify in the written examination will be required to bring with them the hard copy of online application form along with copies of following relevant certificates/documents and originals of the same for verification of their eligibility as per terms and conditions of the advertisement, the date of which shall be notified later on in due course, failing which his/her application will be rejected for the said post. The candidates are required to mention on each copy of documents **"Submitted by me"** and put their **full signature and date on the same**. **They must not attach the original certificates to their applications.**

- (i) H.S.C. or equivalent certificate in support of declaration of age issued by the concerned Board/Council.
- (ii) Mark-sheets of H.S.C, issued by the concerned Board/Council.
- (iii) Degree in Agriculture Engineering Certificate issued by the recognized Universities or Institutions;
- (iv) Mark-sheets of Degree in Agriculture Engineering passed including fail marks if any, issued by the concerned Universities or Institutions;
- (v) Two recent passport size photographs (unsigned and unattested) with the printout / hard copy of online application form which has been uploaded in the online application forms.
- (vi) Any proof of identity;
- (vii) **Caste Certificate by birth in support of claim as SEBC/ SC / ST, wherever applicable (Please see Note: 1);**
- (viii) Required Odia test pass certificate;
- (ix) Disability Certificate (indicating percentage of permanent disability) issued by the concerned Medical Board wherever applicable;

- (x) Discharge Certificates of Ex-Serviceman issued by the Commanding Officer of the Unit last served. Ex-Servicemen should submit an affidavit undertaking that he has not been appointed against any civil post after retirement from military service, wherever applicable.
- (xi) Sports Certificated issued by the Director of Sports Odisha; wherever applicable.
- (xii) No Objection Certificate issued by the competent authority.

**NOTE 1:**

- (i) Candidates claiming to be belonging to S.E.B.C /S.C. /S.T. categories of Odisha by birth are required to submit copy of the relevant Caste Certificate issued by the competent authority in the prescribed form. Candidates of SEBC category (other than creamy layer) must submit copy of caste certificate issued by the Competent Authority within the last three years by the closing date for submission of registered online application form in the prescribed form;
- (ii) The SEBC certificate which is more than three years old by the closing date of submission of registered online application form is liable for rejection;
- (iii) Women candidates belonging to S.E.B.C/S.C. / S.T. categories are required to submit Caste Certificates by birth showing "daughter of .....". Caste Certificates by virtue of marriage (i.e. showing "wife of .....") are not acceptable and liable for rejection.
- (iv) O.B.C. CERTIFICATE WILL NOT BE ACCEPTED IN LIEU OF S.E.B.C CERTIFICATES AND CANDIDATES SUBMITTING O.B.C. CERTIFICATES ARE LIABLE FOR REJECTION.
- (v) Community (Caste status) once mentioned by the candidates shall not be changed under any circumstances.

The competent authorities are: - District Magistrate/ Collector or Additional District Magistrate or Sub-divisional Magistrate/Sub-Collectors or Executive Magistrates or Revenue Officers, not below the rank of Tahasildar /Additional Tahasildar of Government of Odisha.

**NOTE 2:**

Degree Certificate, Caste Certificate, Odia test pass certificate, Discharge Certificate of Ex-servicemen, Sports Person Certificate and Disability Certificate of Person with Disabilities (indicating % of permanent disability), etc. must have been issued by the competent authority within the last date fixed for submission/ receipt of registered online application form.

**10. "GROUNDS OF REJECTION OF APPLICATIONS"**

Applications of candidates will be rejected by the Commission on any of the following grounds: -

- (a) Non-submission of hard copy of online application form at the time of verification of original documents.
- (b) Not possessing the requisite qualifications, within the prescribed age limit and fulfilling other eligibility conditions etc. by the closing date for submission of registered online application form.

- (c) In-complete online application form.
- (d) Not passing Odia test (M.E. standard)/not furnishing Odia test pass evidence as required under Para-7 (ii) of the Advertisement.
- (e) Not coming within the age limit of candidate as mentioned in Para-3 of the advertisement (Overage relaxation shall not be allowed to P.W.D. candidates with less than 40% permanent disability).
- (f) Not having requisite qualification as provided under Para-4 of the advertisement.
- (g) Not furnishing copies of certificates/documents as provided under Para - 9 of the Advertisement.
- (h) Submission of wrong information/ false information about qualification/ Age/ Category status (SEBC/SC/ST/PWD/Ex-Servicemen/Sports Person/Women etc.).
- (i) Suppression of facts / information about eligibility, if any.
- (j) Any other ground as per the decision of the Commission.

**NB:** Application /candidature of a candidate shall be rejected at any stage of recruitment process, whenever discrepancy is noticed/ detected.

**11. HOW TO APPLY:**

- (a) Candidates must go through the details of this Advertisement available in the Website of OPSC before filling up online application form.
- (b) Candidates must apply online through the concerned Website of the OPSC <http://opsc.gov.in>. Applications received through **any other mode** would not be accepted and summarily rejected.
- (c) **Before filling up the online application form, the candidates must go through detailed instructions available at OPSC portal.**
- (d) The online application form is automated and system driven & will guide the candidate seamlessly in filling the application. The requisite options shall be enabled and information shall be asked as per data furnished by the candidate. Before filling up the information, ensure that accurate information is fed, for edit option is limited & on confirmation there is no scope for further edit, even if wrongful entry has been made while filling up online application.
- (e) Candidates are requested to upload the scanned image of latest passport size photograph along with scanned image of his/her full signature and scanned image of Left-hand Thumb Impression (LTI) in the online application form. Uploaded photograph, Specimen (full) signature and LTI must be clearly identifiable / visible, otherwise the application of the candidate is liable to be rejected by the Commission and no representation from the candidate will be entertained.
- (f) Candidates should keep at least two copies of latest passport size photograph which is uploaded to the online application form for future use.

- (g) *On successful submission of the online Registration, a unique "Permanent Public Service Account Number (PPSAN)" will be assigned to the applicant. Candidates are required to take a printout of the finally submitted online Registration/Re-registration and finally submitted Online Application forms and put his/her signature under the declaration for submission to OPSC along with copies of requisite certificate & documents as and when asked.*
- (h) The candidates are advised to submit the Online Application Form well in advance without waiting for the closing date to avoid the last hour rush.
- (i) Certificate of Admission to the written examination to the eligible candidates will be uploaded in the Website of the OPSC prior to the date of written examination, which will be published in the Website of the Commission and widely circulated Newspapers. The candidates are required to download their Admission Certificate from the Website of the Commission and produce the same at the Examination centre for admission to the written examination. No separate correspondence will be made on this score.
- (j) "Intimation letters" to candidates for document verification & interview and "Attestation form" & "Bio-data form" shall be uploaded in the website of OPSC prior to the date of Document Verification/Interview.
- (k) Any complaint on the conduct of examination must be sent to the Grievance Wing of the Commission by e-Mail ([opsc@nic.in](mailto:opsc@nic.in)) within 03 (Three) days of completion of the examination.

## 12. **FACILITATION COUNTER :-**

*To resolve any Technical problem faced in filling up of online Registration/ Re-registration and Application forms, candidate may contact OPSC Technical Support **over Telephone No. 0671-2304707** between 10.30 A.M. to 1.30 P.M. & 2.00 P.M. to 5.00 P.M. on any Odisha Government working days.*

*In case of any guidance/information on this advertisement & recruitment, candidates may go through the **FAQ** available in the website of the Commission or contact the O.P.S.C. Facilitation Counter over Telephone No. 0671-2304141/2305611 & Extn.- 227 on any working day between 10.30 A.M. to 1.30 P.M. & 2.00 P.M. to 5.00 P.M.*

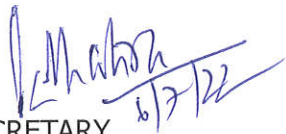
*The candidates are required to visit the website of the Commission at <http://opsc.gov.in> for detailed information about important notices, rejection of applications, the date & time of written examination, document verification & interview and also keep track of publication of various notices to the effect in the leading local daily newspapers for information.*

### **Closing Dates**

**(A) ONLINE REGISTRATION/RE-REGISTRATION AND SUBMISSION OF ONLINE REGISTERED APPLICATIONS CAN BE DONE IN THE WEBSITE FROM 12.07.2022 TO 12.08.2022 (11.59 P.M).**

**NB: - THE ONLINE APPLICATION FORMS IF FOUND DEFECTIVE IN ANY RESPECT, ARE LIABLE TO BE SUMMARILY REJECTED.**

PLACE: CUTTACK  
DATE : 06.07.2022

  
SECRETARY  
ODISHA PUBLIC SERVICE COMMISSION,  
CUTTACK.

## Syllabus for A. A .E. Recruitment Examination

Paper-I		Full Marks: 100
(A) General Engineering		
(B) Farm Machinery and Power		
<b>A. General Engineering (30 Marks)</b>		
<b>Computer Programming and Data Structures</b>	(a) Data types, variables, operators, building and evaluating expressions, standard library functions.	
	(b) Managing input and output, decision making	
	(c) Branching, looping, arrays, string functions	
	(d) Structures and union, queues, insertion and deletion operations	
<b>Workshop practice and Workshop technology</b>	(a) Measuring tools	
	(b) Welding, lathe, shaper, drilling, milling machines- their types, components, specification, tools and functions	
<b>Applied Electronics and Instrumentation</b>	(a) Diode, transistors, logic circuits	
	(b) Generalized instrumentation	
	(c) Measurement of displacement, temperature, velocity, pressure and force	
	(d) Transducer types and applications, strain gauge	
<b>Common Statistical data on agriculture</b>	(a) Statistics on Agriculture (Odisha & India)	
	(b) Land distribution pattern, land use, land holding sizes, major crops, their production and productivity	
	(c) Farm power availability, agriculture workers and draft animals, sale and population of tractors, power tillers, pump sets and implements	
	(d) Water resource availability, irrigation potential	
<b>Units and dimensions</b>	(a) Units and measurement, Fundamental and derived units. Relation between different units of measurement	
	(b) Dimensional analysis	
<b>Surveying and levelling</b>	(a) Linear measurements	
	(b) Types of survey and their applications, estimation of errors in measurements	
	(c) Levelling and contouring	
<b>Building construction and cost estimation</b>	(a) Building materials, building design and construction, agricultural structures, lead and material statement, Building codes	
	(b) Estimates of buildings and agricultural structures	
<b>Design and maintenance of Greenhouse</b>	(a) Types of greenhouse, its components, site selection, design criteria and construction, applications, repair and maintenance	
<b>B. Farm Machinery and Power (70 Marks)</b>		
<b>Farm Machinery</b>	(a) Need of farm mechanization, classification of farm implementations and their suitability	
	(b) Seed bed preparation machineries- MB plough, disc plough, sub-soilers, cultivators, rotavator, harrows, puddlers: their types, components, function & adjustments. Forces acting on tillage tools, hitching systems and controls, draft measurement	



	(c) Seeding and planting equipment-their types, parts, function and adjustment. Metering mechanisms for small and bold seeds, calibration. Rice transplanters-types, component, functions and seedling raising techniques
	(d) Fertilizer application equipment, weeders, plant protection equipment- sprayers and dusters, their calibration, components and adjustments
	(e) Principles & types of cutting mechanisms, crop harvesting machinery- reapers, reaper binders and combine harvesters, mowers and chaff cutters
	(f) Threshers- types, components, functions and principles of threshing. Cotton pickers, sugarcane harvester, potato digger, groundnut digger cum shaker, fruit harvesting tools and machines
	(g) Testing of farm machines, test codes & procedure
Farm power	(a) Sources of farm power. Classification of tractors and IC engines. Engine components and their construction, functions and adjustment.
	(b) Engine systems- valves, fuel & air supply, governing, ignition, cooling, lubrication and electrical systems.
	(c) IC engine fuels and lubricants- their properties. Detonation and knocking
Tractor systems and controls	(a) Transmission systems- clutch, gearbox, differential and final drive. Brake, steering and hydraulic system, P.T.O. shaft, belt pulley and drawbar
	(b) Mechanics of tractor chassis, determination of C.G. of tractor, overturning of tractor, weight transfer
	(c) Tractor maintenance and trouble shooting
Farm power and machinery management	(a) Role of farm mechanization in increasing production and productivity and reducing drudgery. Index of farm mechanization.
	(b) Performance analysis- machine performance, capacity, field pattern, time efficiency, field efficiency. Power analysis
	(c) Cost analysis of farm machines. Break-even analysis- method of finding break-even hour and area of machines. Reliability analysis
Human engineering and safety	(a) Importance of the human engineering in design of farm machinery and workspace
	(b) Ergonomic parameters for evaluation of workers. Anthropometry and its use in machine design. Effect of noise, heat and vibration on operator's efficiency
	(c) Safety aspects of tractors and farm machinery. Safety measures and preventions of accidents.
Precision agriculture	(a) Concepts of precision agriculture- requirements and applications in agricultural production system. Farm implements for precision agriculture

Renewable energy engineering	(a) Biomass conversion technology-types of biogas plants, design & construction and their defects, gasifier technology. Technology and production process of bio-diesel and bio-ethanol
	(b) Solar Energy-fundamentals of solar energy, solar photo Voltaic (PV) system, solar thermal system and their applications in agricultural system
	(c) Wind energy conversion system, its applications and limitations
Systems Engineering	(a) System concepts, Linear programming- formulation and applications, Simplex method, Big M method
	(b) Transportation problems. Assignment problems
	(c) Project management by PERT/CPM
	(d) Waiting line theory.

<b>Paper-II</b>		<b>Full Marks: 100</b>
<b>(A) Agricultural Processing and Food Engineering</b>		
<b>(B) Soil and Water Conservation Engineering</b>		
<b>A. Agricultural Processing and Food Engineering (35 Marks)</b>		
<b>Engineering properties of Food materials</b>	(a)	Importance of engineering properties of biological materials
	(b)	Physical, thermal, frictional and aerodynamic characteristics of grains, fruits and vegetables.
<b>Grain Processing</b>	(a)	Cleaning and grading of food grains: Aspiration, scalping, size separators, screens, sieve analysis, capacity and effectiveness of screens, various types of separators, shape graders
	(b)	Size reduction: Principle, Different laws governing size reduction, size reduction machineries
	(c)	Milling of rice: Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpur methods of parboiling, pressure parboiling method, types of rice milling (traditional and modern rice milling), different unit operations and equipment
	(d)	Milling of wheat and corn: Unit operations and equipment for wheat milling ; Milling of corn and its products: Dry and wet milling
	(e)	Milling of pulses: Traditional milling methods, commercial methods, dry milling and wet milling methods, pulse milling machines
	(f)	Milling of oilseeds: Preconditioning of oilseeds; Mechanical expression, solvent extraction methods, refining of oil, stabilization of rice bran; By-products utilization (Paddy)
	(g)	Material handling equipment: Types of conveyers (belt, roller, chain and screw), elevators, trucks (refrigerated/ unrefrigerated), pneumatic conveying.
<b>Drying and Storage of crops</b>	(a)	Drying: Moisture content and water activity, isotherm, hysteresis effect, EMC determination, psychrometric chart and its use in drying, drying principles and theory, thin layer and deep bed drying analysis, falling rate and constant rate drying periods, drying equations and factors affecting drying, mass and energy balance, Shedd's equation, different methods of drying, tempering during drying, different types of grain dryers, dryer performance.

	(b) Storage of food grains: Basics of Storage, functional requirement of storage, Types and causes (factors) of spoilage respiration of grains, moisture and temperature changes. Control measures of storage environment; Ventilation/Aeration; symptoms, damages, control measures of destructive agents like rodents, birds, insects and microbes. Bag and bulk storage; traditional storage structures; Bag storage design. Improved and modern storage systems. Shallow and Deep bin/silo, Rankine, Janssen and Airy's equation. Storage of seeds, hermetically sealed and CAP storage. Godown and Ware house design.
Horticultural Produce Processing	(a) Fruits and Vegetables processing: Cleaning, sorting, grading; Juice extractors; Mechanical filtration-plate and frame filter press, shell and leaf filter, bag filter, Different types of dryers for fruits and vegetables
	(b) Storage of fruits and vegetables: Evaporatively cooled storage structures; Refrigerated storage; Calculation of refrigeration load; sizing and economics of cold storage. Modified and Controlled atmospheric storage. Advantages of CAS/MAP, active and passive MAP, different types of active agents for controlling oxygen, CO <sub>2</sub> and ethylene in packages; Shrink and Cling packaging, Vacuum and gas packaging; antimicrobial food packaging; Smart packaging.
	(c) Thermal processing: Thermal death time, D and Z value, Process time, thermal processing equipment
	(d) Evaporation: Objectives of evaporation, basic components of evaporators, different types of evaporators. Multiple effect evaporation, mass and energy balance in evaporation
	(e) Freezing: Freezing time, freezing curve, different types of freezing equipment
	(f) Food laws: Food Laws and Regulations in India (FSSAI); Food Standards (BIS Standards and specifications, Codex Alimentarius Standards, International Standards Organisation (ISO).
<b>B. Soil and Water Conservation Engineering (65 Marks)</b>	
<b>Fluid Mechanics</b>	(a) Properties of fluids: Ideal and real fluid
	(b) Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, metacentre and metacentric height
	(c) Kinematics of fluid flow
	(d) Dynamics of fluid flow, flow in pipes, power transmission through pipe
	(e) Dimensional analysis, types of similarities, dimensionless numbers

<b>Irrigation Engineering</b>	(a) Major, medium and minor irrigation projects
	(b) Sources of irrigation water, Measurement of irrigation water, water conveyance, design of irrigation field channels, underground pipe conveyance system, irrigation structures, channel lining.
	(c) Land grading, different design methods and estimation of earth work and cost
	(d) Soil water plant relationship, infiltration, evapotranspiration, soil moisture constants, depth of irrigation, frequency of irrigation, irrigation efficiencies
	(e) Surface irrigation methods of water application
	(f) Basic concepts of command area- definition, need, scope and development approaches: command area development authorities. Planning and execution of on farm development activities within the scope of command area development, design of field channels; cross drainage works, Participatory irrigation management
	(g) Types and Components of micro-irrigation system, Micro-irrigation system; Sprinkler and Drip irrigation-design, installation and maintenance.
<b>Drainage Engineering</b>	(a) Drainage, objectives of drainage. Surface drainage, drainage coefficient, types of surface drainage.
	(b) Sub-surface drainage purpose and benefits, investigations of design parameters, hydraulic conductivity, drainable porosity, water table etc., types and use of subsurface drainage system.
	(c) Design of surface drains, interceptor and relief drains. Derivation of ellipse (Hooghoudt's) and Ernst's drain spacing equations
	(d) Design of surface drainage system. Drainage materials, drainage pipes, drain envelope. Layout, construction and installation of drains, Drainage structures.
	(e) Salt balance, reclamation of saline and alkaline soils. Leaching requirements
<b>Groundwater, Wells and Pumps</b>	(a) Occurrence and movement of ground water, aquifer and its types, classification of wells.
	(b) Well Hydraulics, Well interference, multiple well systems, Design of open well.
	(c) Tube well design, design of gravel pack, well screen, sanitary protection. Methods of drilling of wells; and development of well
	(d) Quality of ground water, Conjunctive use, artificial groundwater recharge planning
	(e) Pumping Systems: Water lifting devices; classification of pumps, component; parts of centrifugal pumps: pump selection, installation and troubleshooting; performance curves, hydraulic ram.

<b>Hydrology</b>	(a) Introduction; hydrologic cycle; precipitation- forms, rainfall measurement, mean rainfall, depth and frequency analysis of point rainfall
	(b) Geomorphology of watersheds
	(c) Runoff- factors affecting, measurement; stage and velocity, rational method, Curve number method; hydrograph
	(d) Head water flood control- methods, retards and their location
	(e) Flood routing- graphical methods of reservoir flood routing.
<b>Soil, Water Conservation Engineering and Watershed Management</b>	(a) Soil erosion- causes, types and agents of soil erosion; gullies and their classification, stages of gully development, Universal soil loss equation
	(b) Erosion control measures- agronomical measures; engineering measures- terraces- types, their design, layout procedure and planning, bunds and their design; temporary gully control structures, Permanent gully control structures-drop, chute and pipe inlet spillway and their design.
	(c) Wind erosion- types and control measures
	(d) Sedimentation in reservoirs and streams; estimation, measurement and control measures, Introduction to stream water quality and pollution.
	(e) Land use capability classification
	(f) Grassed waterways and their design
	(g) Introduction to water harvesting techniques
	(h) Small earth embankments- their types and design principles, farm ponds and reservoirs, cost estimation of structures
	(i) Watershed management- problems and prospects; Watershed based land use planning, watershed characteristics- physical and geomorphologic parameters, factors affecting watershed management, planning and formulation of project proposal.