

ODISHA PUBLIC SERVICE COMMISSION
ADVERTISEMENT NO. 03 OF 2015-16

Recruitment to the post of Asst. Executive Engineer (Civil) and Asst. Executive Engineer (Mechanical) in Group- 'A' of Odisha Engineering Service under Water Resources Dept.

WEBSITE – <http://opsconline.gov.in> and <http://opsc.gov.in>

- REMEMBER:**
- (i) **LAST DATE FOR SUBMISSION OF ON LINE APPLICATION IS 27.05.2015 BY 11:59 P.M.**
 - (ii) **LAST DATE FOR DEPOSIT OF APPLICATION FEE AT ANY BRANCH OF STATE BANK OF INDIA (S.B.I.) IS 29.05.2015.**
 - (iii) **LAST DATE FOR RECEIPT OF PRINT OUT/HARD COPY OF ONLINE APPLICATION ALONGWITH COPY OF SPECIFIED DOCUMENTS/ CERTIFICATES IS 12.06.2015 BY 5.00 P.M.**

Applications are invited Online from the prospective candidates through the proforma Application to be made available on WEBSITE (<http://opsconline.gov.in>) from **27.04.2015 to 27.05.2015** (Note: **29.05.2015** is the last date for payment of application fees) for recruitment to **657 posts of Assistant Executive Engineer (Civil) and 25 posts of Assistant Executive Engineer (Mechanical) in Group-A** of Odisha Engineering Service under Water Resources Department, Works Department and H & U.D. department in the scale of pay of ₹15,600/- – ₹39,100/- with Grade Pay of ₹5,400/- in P.B.-3with usual Dearness Allowance and other Allowances as may be sanctioned by the Government of Odisha from time to time.

2. **Vacancy Position:** As per requisition filed by the Water Resources Department of Government of Odisha the vacancy position is given below:

A. Assistant Executive Engineer (Civil)

i) Under H & U.D. Department:

Sl. No.	Category	No of vacancies	No of Post reserved for P w D
1	UR	57 (19-w)	(i) O.H.- 02 (ii) H.I.- 02 Total- 04
2	SC	24 (08-w)	
3	ST	38 (13-w)	
4	SEBC	15 (05-w)	
Total		134 (45-w)	

ii) Under W.R. Department (Major & Medium Irrigation wing):

Sl. No.	Category	No of vacancies	No of Post reserved for P w D
1	UR	147 (49-w)	(i) O.H.- 05 (ii) H.I.- 04 Total - 09
2	SC	0	
3	ST	111 (37-w)	
4	SEBC	33 (11-w)	
Total		291 (97-w)	

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iii) Under Works Department

Sl. No.	Category	No of vacancies.	No of Post reserved for P w D
1	UR	109 (36-w)	(i) O.H.- 04 (ii) H.I.- 03 Total - 07
2	SC	19 (06-w)	
3	ST	78 (26-w)	
4	SEBC	26 (09-w)	
Total		232 (77-w)	

NOTE :- The candidates are required to give their preference/choice of Departments in their online application form for the post of Assistant Executive Engineer (Civil).

B. Assistant Executive Engineer (Mechanical)

(Under Water Resources Dept.)

Sl. No.	Category	Total Vacancies	No of Post reserved for P w D
1	UR	12 (04-w)	O.H./ H.I. - 01 Either O.H. or H.I. category with higher score and preference to O.H. category when scores are equal.
2	SC	05 (02-w)	
3	ST	06 (02-w)	
4	SEBC	02	
Total		25 (08-w)	

NOTE :- The Physical requirement and Functional Classification for the above posts, as specified in G.A. Department Resolution No. 34450 dated 03.12.2013, for the candidates belongs to Physically with Disabilities are mentioned below:-

Name of the Post	Physical Requirements	Categories of disabled suitable for the job
Assistant Executive Engineer (Civil)	S, ST, BN, W, SE, RW, H, C	HI (with suitable aid), OA, OL, BL (MNR)
	Note:- { S - work performed by sitting (on bench or chair), ST -work performed by standing, BN -work performed by bending, W - work performed by walking, SE - work performed by seeing, RW -work performed by reading and writing, H - work performed by hearing/speaking, C - work performed by communication}	Note:- { HI -Partially deaf (with suitable aid), OA - one arm affected (R or L)- (a) impaired reach; (b) weakness of grip; (c) ataxia, OL - one leg affected (R and/or L), BL - both legs affected but not arms (Mobility not be restricted)}
Assistant Executive Engineer (Mechanical)	ST, BN, SE, W, F	OA, HI (with suitable aid), OL (MNR)
	Note:- { ST - work performed by standing, BN -work performed by bending, SE - work performed by seeing , W - work performed by walking, F -work performed by manipulating (with fingers)}	Note:- { OA - one arm affected (R or L)- (a) impaired reach; (b) weakness of grip; (c) ataxia, HI -partially deaf (with suitable aid), OL - one leg affected (R and/or L) (Mobility not be restricted)}

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- NOTE:** (a) The probation period of the above post is two years.
(b) In the event of non-availability or availability of insufficient number of eligible women candidate(s) belonging to any particular category, the remaining vacancies will be filled up by male candidate(s) of that category.
(c) Exchange of reservation between Scheduled Caste and Scheduled Tribe will not be considered in the event of non-availability of eligible and suitable S.C./S.T. candidates .
(d) The number of vacancy to be filled up on the basis of this recruitment is subject to change by Government without notice, depending upon the exigencies of public service at the discretion of the State Government.
(e) Candidates belonging Physically Disabilities shall be adjusted against the categories to which they belong.

3. EDUCATIONAL QUALIFICATION: A candidate must hold a Degree in Engineering in Civil/Mechanical or an equivalent qualification from any University or Institution recognized by the Government or he must be an Associated Member of the Institution of Engineers of India in Civil/Mechanical.

4. AGE: A candidate must be under 32 (thirty-two) years and above 21 (twenty one) years of age as on the 1st January, 2015 i.e. he/she must have been born not earlier than 2nd January 1983, and not later than 1st January 1994.

The upper age limit is relax-able by 5 (five) years for candidates belonging to the categories of Scheduled Castes(S.C.), Scheduled Tribes (S.T.), Socially & Educationally Backward Classes (S.E.B.C.), Women, Ex-servicemen, and by 10 (ten) years for candidates belonging to Physically Handicapped (**Orthopedically Handicapped**) category, whose disability should not be less than 40%.

Provided that, a candidate who comes under more than one category mentioned above, he/she will be eligible for only one age relaxation benefit, which shall be considered most beneficial to him/her.

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.

5. APPLICATION FEE: A candidate is required to pay a non-refundable and non-adjustable fee of ₹300/-(Rupees three hundred) only. **Candidates belonging to Scheduled Caste/ Scheduled Tribe of Odisha and Persons with disability (whose disability is not less than 40%) are exempted from payment of this fee.**

6. METHOD OF SELECTION: The selection of candidates for recruitment to the above posts shall be made on the basis of Objective Type Written Test and Viva Voce test. The weight-age on objective type written test shall be 90% (ninety per cent) and weight-age on viva test shall be 10% (ten per cent). The Commission will prepare a common merit lists in respect of Assistant Executive Engineer (Civil) and Assistant Executive Engineer (Mechanical) for allotment to different departments as per their preference and ranking given in their online application/hard copy.

The broad outlines of the syllabi for the said examination are available in the **Annexure-I (Civil Engineering) & Annexure-II (Mechanical Engineering)**.

7. PLACE OF EXAMINATION

The written examination for the post of Assistant Executive Engineer (Civil) and Assistant Executive Engineer (Mechanical) will be held at Cuttack. It may also be held at Bhubaneswar, Balasore, Berhampur and Sambalpur depending on the number of candidates from the respective zone.

The candidates are to mention their choice of examination Zone at appropriate place in the online application form.

9. OTHER ELIGIBILITY CONDITIONS:

- (i) The candidate must be a citizen of India;
- (ii) The candidate must be of (a) good moral character, and (b) good mental condition and bodily sound health, good physique and active habits and free from organic defects or bodily infirmity so as not to create an impairment in the due discharge of duties;
- (iii) The candidate must be able to speak, read and write Odia and have (i) passed Middle School Examination with Odia as a Language subject; or (ii) passed Matriculation or equivalent Examination with Odia as medium of examination in non- language subjects; or (iii) passed in Odia as language subjects in the final examination of Class-VII from a school or Educational Institutions recognized by the Government of Odisha or the Central Government; or (iv) passed a test in Odia in Middle English School Standard conducted by the School and Mass Education Department/Board of Secondary Education, Odisha or the Education Department of Government of Odisha or any other Board or Council of Secondary Education approved by the Government of Odisha in support of passing of Odia Language Test (M.E. School standard);
- (iv) 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;
- (v) 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 & 4 of the Advertisement. They must inform their respective Heads of Offices/Departments in writing regarding submission of their applications for this recruitment and obtain "No Objection Certificate";
- (vi) 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/interview, he/she will not be eligible for such recruitment for that specified period/chance(s);
- (vii) **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 online application form, will be considered eligible;**

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- (viii) 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 news paper as well as copy of notification in the Odisha Gazette in support of his/her change of name.
- (ix) 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;

10. OTHER CONDITIONS:

- (i) The provisions of the Odisha Conduct of Examination Act 1988 (Odisha Act-2 of 1988) are applicable to the examination conducted by the Odisha Public Service Commission.
- (ii) A candidate found guilty of seeking support for his/her candidature by offering illegal gratification or applying pressure on any person connected with the conduct of the recruitment process or found indulging in any type of malpractice in course of the selection or otherwise, shall, in addition to rendering himself/herself liable to criminal prosecution, be disqualified not only for the recruitment for which he/she is a candidate, but also may be debarred, either permanently or for a specified period, from any recruitment or selection to be conducted by the Commission;
- (iii) **Applications submitted by the candidate to OPSC, if found to be incomplete in any respect and at any stage are liable to rejection without entertaining any correspondence with the applicants on that score;**
- (iv) Admission to Examination will be purely **provisional**. If on verification at any stage before or after the Examination, it is found that a candidate does not fulfill 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.
- (v) This advertisement should not be construed as binding on the Government to make appointment;
- (vi) Concessions meant for S.C., S.T. & SEBC **by Birth** are admissible to the Scheduled Caste, Scheduled Tribe and Socially & Educationally Backward Classes of **Odisha** only;
- (vii) Candidates are required to take due care to annex the Xerox copies of certificates and other requisite documents with the printout/hard copy of online applications, as stated under Para-11 of this advertisement.
- (viii) All persons appointed under the Government of Odisha on or after 1st January, 2005 shall not be eligible for pension as defined under Sub-rule (1) of Rule-3 of the Odisha Civil Service (Pension) Rules, 1992; but shall be covered by the new structured defined Contribution Pension Scheme in accordance with the Odisha Civil Services (Pension) Amendment Rules, 2005;
- (ix) **Any misrepresentation or suppression of information by the candidate in the online application and in the hard copy of application will result in cancellation of his/her candidature or penalty as decided by the Commission will be imposed on the candidate.**

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- (x) Mere empanelment in the select list shall not confer any right for appointment unless the Government is satisfied after making such enquiry as may be deemed necessary that the candidate is suitable in all respects for appointment to the service.

11. CERTIFICATES/DOCUMENTS TO BE ATTACHED:

Candidates are required to submit true copies of the following certificates and documents along with the printout/hard copy of online applications, duly attested by the candidate or a Gazetted Officer or Notary Public. The candidates are also required to mention on each document “submitted by me” and put their full signature with date on the same. They must not attach Original Certificates/Documents with their applications. Only those candidates, who are called for the *viva voce* test, will be required to bring with them the original certificates, original mark-sheets etc. of the attested copies for verification at the time of *viva voce* test.

If a candidate fails to furnish any of the original certificates and documents in respect of the attested copies submitted with the application by him/her, for verification on the date of interview, before the interview starts, he/she shall not be allowed to appear at the interview.

- (i) H.S.C. Pass or equivalent Certificate in support of declaration of age issued by the concerned Board/Council;
- (ii) Intermediate/+2 Sc. Pass Certificate issued by the concerned University/Council;
- (iii) Degree/Diploma (i.e. Engineering in Civil or Mechanical) pass certificate issued by the recognized University;
- (iv) Mark-lists of all semesters/Annual Examinations in support of Degree/Diploma (Engineering in Civil or Mechanical) passed including fail marks, if any, issued by the concerned Board/Council/University;

NOTE :

- (a) Candidates who have not been awarded percentage of marks, but only “**GRADE MARKS**”, should, along with their applications, produce the Conversion Certificate from the concerned University indicating the actual equivalent percentage of marks and the conversion formula, failing which, their applications are liable to be rejected.
- (b) While filling up the relevant box of the online application form, the candidate has to mention the marks secured (**excepting marks secured in the Extra Optional/4th Optional Subject**) in each examination passed (i.e. H.S.C. to Degree/Diploma).
- (v) A “No Objection Certificate” from the Head of Office/Head of the Department in case of Government Servant;
- (vi) Attach two recent passport size photographs (unsigned & unattested), with the printout/hard copy of online application form which has been uploaded;
- (vii) Certificates of character and conduct from the Principal/Proctor/Dean or Professor in charge of Teaching Department of the College or University in which he/she last studied;
- (viii) Candidates claiming to belong to S.C./S.T./S.E.B.C. category **BY BIRTH** are required to enclose with applications, the copies of the recent relevant Caste/Tribe Certificates issue by the competent authority in the prescribed form.
- (ix) Required Odia Pass Certificate from the Board of Secondary Education, Odisha indicating Odia as a language subject equivalent to M.E. School Standard or a certificate from the Principal/Headmaster of the School indicating that the candidate has passed Odia in M.E. standard; if not passed Odia as a subject in the High School Certificate Examination/equivalent Examination;

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- (x) Discharge Certificates of Ex-Serviceman issued by the Commanding Officer of the Unit last served wherever applicable;
- (xi) Physically Handicapped candidates are required to attach copy of their Identity card issued by the District Social Welfare Officer along with the Disability Certificate (indicating percentage of disability) issued by the concerned Medical Board, wherever applicable;
- (xii) If a candidate claims to possess qualification, equivalent to the prescribed qualification, the rule/authority (With number and date) under which it is so treated, must be furnished with the Application Form;
- (xiii) OPSC copy of Challan showing payment of examination fees, wherever applicable.

NOTE-1: Candidates claiming to be belonging to S.C./S.T./S.E.B.C. category 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 from the date of advertisement in the prescribed form.

- (i) Women candidates belonging to S.C./S.T./S.E.B.C. 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.
- (ii) OBC CERTIFICATES **WILL NOT BE ACCEPTED** IN LIEU OF SEBC CERTIFICATES AND CANDIDATES SUBMITTING OBC CERTIFICATES WILL BE TREATED AS UN-RESERVED CANDIDATES.
- (iii) Candidate if submits S.E.B.C. certificate which is more than three years old as on the date of advertisement, will be treated as U.R. category.
- (iv) Community (Caste status) once mentioned by the candidates shall not be changed under any circumstances.

The competent authorities to issue caste certificates 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 and Discharge Certificate of Ex-Serviceman must have been issued by the competent authority within the last date fixed for submission of online application form.

12. HOW TO APPLY:

- (a) Candidate must go through this Advertisement available in the Website of OPSC before filling up online application.
- (b) **Candidates must apply online through the concerned website <http://opsconline.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 the following documents available at OPSC portal.**
 - i) **Instructions to fill up online application.**
 - ii) **Guidelines for scanning and Uploading of Photograph, Full Signature & Left Thumb Impression.**

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- (d) Candidates are required to upload the scanned image of latest passport size colour photograph along with scanned image of his/her full signature and scanned image of Left Thumb Impression (L.T.I.) in the online application form. **The Uploaded photograph, specimen (full) signature and L.T.I. 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.
- (e) Candidates should keep at least 2 copies of latest passport size photograph which is uploaded on the online application form for future use.
- (f) While filling up the relevant box of the online application form, the candidate has to mention details of marks (**minus extra optional**) secured in each Annual examination leading to award of Degree.
- (g) On successful submission of the Online Application Form, a Unique Registration ID will be displayed on the screen as well as on the top of the application form. Candidates are required to note down the Unique Registration ID for future reference and take a printout of the finally submitted online application form and put his/her signature under the Declaration (available in 2nd page) for submission to O.P.S.C. along with copies of requisite certificates and documents.
- (h) **Thereafter, the candidates who are required to pay the fee shall take a printout of Online Challan (Pay-in-Slip) for payment of requisite fee of ₹300/- (Rupees three hundred) only at any branch of State Bank of India (SBI). The Fee paid shall not be refunded under any circumstances nor can the fee be adjusted or held in reserve for any other examination or recruitment.**
- (i) Candidates are required to send the Printout/Hard copy of the filled in Online Application **duly signed under the declaration** along with copies of required certificates and documents etc., as provided under Para-11 of this Advertisement, copy of Challan showing payment of Application Fee, **by Registered Post/Speed Post** to the Special Secretary, Odisha Public Service Commission, 19, Dr. P.K. Parija Road, Cuttack -753001 so as to reach the same in the office of the OPSC **on or before 12.06.2015.**
- The envelope containing the printout/hard copy of the Online Application along with requisite certificates and documents etc must be super scribed **“APPLICATION FOR THE POST OF ASST. EXECUTIVE ENGINEER IN (CIVIL/MECHANICAL) IN GROUP- ‘A’.** Application received after the closing date shall not be entertained. The Commission will not take any responsibility if the Application is not received in time.
- (j) **The candidates are advised to submit the Online Application well in advance without waiting for the closing date to avoid last hour rush.**
- (k) Certificate of admission to the examination/interview to the eligible candidates will be uploaded in the website of the OPSC prior to the date of examination or interview which will be published in the website and news paper. The candidates are required to download their Admission Certificate from the website of the Commission and produce the same for admission to the examination. No separate correspondence will be made on this score.

13. FACILITATION COUNTER AND WEBSITE FOR GUIDANCE OF CANDIDATES :-

For any technical guidance on filling up of online application, the candidates may contact facilitation counter of O.C.A.C. over **Toll free No. 1800 345 6770 or 155335** between 10.30. A.M. to 1.30 P.M. and 2.00 P.M. to 5.00 P.M. on any Odisha Government working days.

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Regarding difficulty in payment of fee, if any, the candidates may contact SBI over **Telephone No. 0671-2368267 and 9437039604.**

In case of any guidance/information on this advertisement and recruitment, candidates may contact the O.P.S.C. Facilitation Counter over Telephone No. 0671-2304141/2305611 and Extn.-223 or 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 the programme of the examination/interview, notice regarding rejection of applications; other important notices etc. and also keep track of publication of various notices to the effect in the leading local daily news papers for information.

CUTTACK

DATE: 17.04. 2015

SPECIAL SECRETARY
ODISHA PUBLIC SERVICE COMMISSION,
CUTTACK.

ANNEXURE – I

Civil Engineering Syllabus.

Paper I

1. **SOLID MECHANICS:-** Elastic constants, plane stress, plane strain, Mohr's circle, combined stress; Elastic theories of failure; Simple bending, Shear; Torsion of circular and rectangular sections and simple members. Bending Moment and Shear Force in statically determinate beams.
2. **STRUCTURAL ANALYSIS:-** Analysis of determinate structures - different methods including graphical methods. Analysis of indeterminate skeletal frames - moment distribution, slope deflection, stiffness and force methods, energy methods, Muller-Breslau principle and application. Plastic analysis of indeterminate beams and simple frames - shape factors. Basic concepts of matrix method of structural analysis
3. **DESIGN OF CONCRETE STRUCTURES:-** Limit state design for bending, shear, axial compression and combined forces. Codal provisions for slabs, beams, walls and footings. Principles of prestressed concrete design, materials, methods of prestressing, losses. Design of simple members.
4. **DESIGN OF STEEL STRUCTURES (Based on Limit State Method):-** Analysis and design of tension and compression members, Column bases, Connections- simple and eccentric beam-column connections. Plate girders and trusses.
5. **BUILDING MATERIALS and BUILDING CONSTRUCTION:-**
 - (a) **Building Materials:-** **Cement:** Components, different types, setting times, strength. *Cement Mortar:* Ingredients, proportions, water demand, mortars for plastering and masonry. **Concrete:** Importance of W/C Ratio, Strength, ingredients including admixtures, workability, testing for strength, non-destructive testing, mix design methods. **Bricks:** Types, Indian Standard classification, absorption, saturation factor, strength in masonry.
 - (b) **Building Construction:-** Types of Foundations, Brick masonry, Stone masonry, Floorings, Causes and prevention of cracks in buildings, Damp proofing, Special maintenance of buildings.
6. **ESTIMATION, CONSTRUCTION PLANNING AND MANAGEMENT:-** Preliminary estimate, Detailed estimate, Specifications and cost analysis. Bar chart, Linked bar chart, Work-breakdown structures, Activity- on – arrow diagrams, critical path, probabilistic activity durations, Event- based networks, PERT networks: Time- cost study, Resource allocation.

Paper II

1. WATER RESOURCES AND HYDRAULIC ENGINEERING:-

- (a) **Irrigation Engineering:-** Consumptive use of water, irrigation systems, water demand assessment; Storages and their yields, ground water and well hydraulics; Waterlogging, drainage design; Design of rigid boundary canals, Lacey's and Tractive force concepts in canal design, lining of canals; Sediment transport in canals; Forces acting on gravity dams and their design, Design of headworks, distribution works, falls, Cross-drainage works, outlets; River training
- (b) **Hydrology:-** Hydrological cycle, precipitation and related data analyses, Probable maximum precipitation, unit hydrograph and synthetic unit hydrographs; Evaporation and transpiration; Floods and their management, Design Flood, Streams and their gauging; Routing of floods; Capacity of Reservoirs.

(c) **Fluid Mechanics**:- Fluid Properties, Pressure, Thrust, Buoyancy; Flow Kinematics; Integration of flow equations; Flow measurement; Relative motion; Moment of momentum; Viscosity, Boundary layer and Control, Dimensional Analysis, Flow development, losses in pipe flows, Pipe networks, Flow measuring equipment and structures.

(d) **Open Channel Flow**:- Momentum and Energy principles in Open channel flow, Types of flow, Flow sections and properties; Normal flow, Gradually varied flow, Hydraulic jump.

2. **ENVIRONMENTAL ENGINEERING**

(a) **Water Supply Engineering**:- Sources of supply, design of intakes, Estimation of demand; Water quality standards; Primary and secondary treatment, detailing and maintenance of treatment units; Conveyance of treatment units; distribution systems of treated water, leakages and control; Institutional and industrial water supply.

(b) **Waste Water Engineering**:- Urban rain water disposal; Quantity and characteristics of waste water, Collection of waste water, Primary, Secondary and tertiary treatment of waste water, Sludge disposal, effluent discharge standards, Institutional and industrial sewage management.

(c) **Solid Waste Management**:- Characteristics, Generation, Collection and Transportation, Engineered systems of solid waste management (reuse, recycle, recovery, treatment and disposal). Design and Management of landfills.

(d) **Air and Noise Pollution**:- *Air pollution*: sources and impacts, air pollution controls, standards and limits. *Noise pollution*- impacts of noise, permissible limits, measurements and control of noise pollution.

3. **GEOTECHNICAL ENGINEERING**:-

(a) **Soil Mechanics**:- Fundamental definitions and interrelationships; Properties and Classification of soils, Permeability and seepage, Effective stress principles, Shear strength, Consolidation, Compaction, stress distribution in soils.

(b) **Foundation Engineering**:- Types of foundations, Foundation design requirements, Shallow foundations - bearing capacity, settlement analysis in sands and clays, Deep foundations- pile types, dynamic and static formulae, load carrying capacity of piles in sands and clays, group action, negative skin friction, Earth pressure theories, effect of water table, layered soils, Stability of slopes, Sub-surface investigations- scope, drilling bore holes, sampling, penetration tests, plate load tests, geophysical tests.

4. **TRANSPORTATION ENGINEERING**:-

(a) **Highway Engineering**:- Geometric design of highways, Testing and specifications of paving materials, design of flexible and rigid pavements

(b) **Traffic Engineering**:- Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

5. **SURVEYING**:- Principles and classification of surveys, mapping concepts, Coordinate systems, Measurement of distance and directions, Levelling, Theodolite traversing, Contours, Plane table surveying, Errors and adjustments, Curves, Total station, Concept of Global Positioning System; Photogrammetry and Remote Sensing concepts.

Distribution of Marks for Civil Engineering

Paper – I

Number of multiple choice questions:

1. Solid Mechanics – 20
2. Structural Analysis – 20
3. Design of concrete structure – 15
4. Design of steel structure – 10
5. Building Material and Building Construction – 15
6. Estimation, Construction Planning and Management – 10

Total number of questions – 90. Duration of Examination – 3 hours.
Each question carries two marks.

Paper – II

Number of multiple choice questions:

1. Water Resources and Hydraulic Engineering – 25
2. Environmental Engineering – 15
3. Geotechnical Engineering – 25
4. Transportation Engineering – 15
5. Surveying – 10

Total number of questions – 90. Duration of Examination – 3 hours.
Each question carries two marks.

ANNEXURE – II

Mechanical Engineering Syllabus.

Paper-I

1. Theory of Machines:- Kinematic chain, Mechanisms and inversions, Motor Vehicle steering gears, Hookes' Joint, Toothed gears, Tooth profiles, Interference, Gear Trains, Compound gears, Differential, Cam profiles, Displacement, velocity and acceleration of cam followers, Flywheel and Turning moment diagram.

Governors, Stability, Sensitivity, Isochronism and hunting, Governor effort and power, Controlling force and effect of friction, Balancing of revolving masses.

Balancing of single and multicylinder engines, Friction and lubrication, Hydrodynamic theory of lubrication, Linear free and forced vibration of single and two degree freedom mechanical systems with or without damping, Critical speeds and whirling of shafts, Vibration of beams, Torsional vibration.

2. Machine Design:- Design of Joints: Cotters, Keys, splines, welded joints, threaded joints, threaded fasteners, joints formed by interference fits, Design of friction drives: coupling and clutches, belt and chain drives, power screws.

Design of power transmission systems: gears and gear drives shaft and axle, wire ropes, Design of bearings: hydrodynamic bearings and rolling element bearings.

3. Mechanics of Solids:- Stress and strain for materials in tension, compression and shear, Relation between elastic constants for an isotropic, linear elastic and homogeneous materials, Uniaxial Loading, Thermal stresses, Stress-strain diagrams for ductile and brittle materials, Stress and strain in two dimensions, Principal planes, Mohr's circle, Strain rosette. Bending moment and shear force diagrams. Composite beams. Bending stresses, Shear stress distribution. Slope and deflection in beams. Torsion of circular shafts. Helical springs. Combined stresses. Theories of failure. Thick and thin walled pressure vessels, shrink-fit. Struts and columns. Energy principles. Strain energy due to bending, twisting and axial load. Castigliano's theorem. Reciprocal Theorem. Slope and deflection by energy methods.

4. 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. Iron-carbon equilibrium diagram, TTT-diagram. Heat treatment of steels, Plastics, Ceramics and composite Materials, Common applications of various materials.

5. Manufacturing Science:- Basic principles of forging, drawing, extrusion and rolling, Pattern, Gating and risering system, casting defects, special casting process, welding: Gas welding, arc welding, resistance welding, thermit welding. Cutting tool materials, Tool geometry and nomenclature ASA, ORS and NRS, types of chips, cutting variables, Chip reduction coefficient, Merchant's force diagram, velocity relationship and Kronenberg's relationship. Ernest & Merchant angle relationship, Lee-shafer relationship-cutting fluid, Tool wear, Taylor's tool life equation, Drilling, Milling and boring, Gear Manufacturing, Economics of metal machining, Jigs and fixtures. Fits and Tolerances, NC, CNC, ECM, EDM, AJM, USM, LBM, Plasma machining, High energy rate forming.

6. 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.

Paper-II

1. Thermodynamic Cycles:- Basic concepts. Open and closed systems, Applications of laws of Thermodynamics, (Zeroeth, First and Second Laws), Gas equations, Clapeyron equation, Availability, Irreversibility and Tds relations, reciprocating air compressors.

2. I.C. Engines, Fuels and Combustion:- Spark ignition and compression ignition engines, Two stroke and Four stroke engines, mechanical, thermal and volumetric efficiency, Heat balance. Combustion process in S.I. and C.I. engines, preignition detonation in S.I. engine, Diesel knock in C.I. engine, Choice of engine fuels, Octane and Cetane ratings. Alternate fuels, Carburetion 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. Overall heat transfer coefficient, Fundamentals of diffusive and convective mass transfer, Radiation laws, heat exchange between black and non black surfaces, Network Analysis. Heat pump, refrigeration cycles (Air refrigeration, vapour compression and absorption refrigeration) and systems, Condensers, evaporators and expansion devices and controls. Properties and choice of refrigerant, Refrigeration Systems and components, psychometrics, comfort indices, cooling load calculations, solar refrigeration.

4. Fluid Mechanics:- Properties and classification of fluids, Manometry, Forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floating bodies, Kinematics and dynamics: Continuity, Momentum and Energy Equations, Irrotational flow and incompressible, Inviscid flow, Velocity potential, Pressure field and forces on immersed bodies, Bernoulli's equation, Fully developed flow through pipes, Pressure drop calculations, Measurement of flow rate and Pressure drop, Elements of boundary layer theory, Integral approach, Laminar and turbulent flows, Separations, Flow over weirs and notches, Open channel flow, Hydraulic jump, Dimensionless numbers, Dimensional analysis, Similitude and modelling, One-dimensional isentropic flow, Flow through convergent-divergent ducts. Adiabatic and Isentropic flow, fanno lines, Rayleigh lines.

5. Fluid Machineries and Power Plants:- Theory and design of axial flow turbines and compressors, Reciprocating and centrifugal pumps, Impulse and Reaction turbines, Specific speed, Classification, Energy transfer, Flow through turbo-machine blades, cascades, centrifugal compressor. Dimensional analysis and modelling. Steam generators, Fire-tube and water tube boilers, Flow of steam through nozzles and diffusers, wetness and condensation, various types of steam and gas turbines, 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.

Distribution of Marks for Mechanical Engineering

Paper-I

Number of multiple choice questions to be prepared:

- | | |
|------------------------------|----|
| 1. Theory of Machines: | 15 |
| 2. Machine Design: | 15 |
| 3. Mechanics of Solids: | 15 |
| 4. Engineering Materials: | 15 |
| 5. Manufacturing Science: | 15 |
| 6. Manufacturing Management: | 15 |

Total number of questions: 90, Time: 3 Hours, Each question carries two marks.

Paper-II

Number of multiple choice questions to be prepared:

1. Thermodynamics Cycles:	05
2. I.C. Engines, Fuels and Combustion:	15
3. Heat Transfer, Refrigeration and Air Conditioning: (10+10+10)	30
4. Fluid Mechanics:	20
5. Fluid Machineries and Power Plants:	20

Total number of questions: 90, Time: 3 Hours, Each question carries two marks.

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