

CIVIL ENGINEERING

जलसंपदा विभाग (WRD)

TECHNICAL SUBJECTS

स्थापत्य अभियांत्रिकी सहाय्यक
(CEA)

21 SUBJECTS

STRICTLY BASED ON

TCS & IBPS

PATTERN

संपूर्ण
मार्गदर्शक

FEATURES

- Based on New Revised Updated Syllabus
- Included MCQ's for all subjects
- Framed by Experts & Experienced faculties
- For better understanding arranged in simple & Easy language
- All in one book

INCLUDED

Previous Year Questions
WRD 2019 Exam
All Shifts



CIVIL ENGINEERING

Degree/Diploma/ITI

संपूर्ण मार्गदर्शक

1500⁺ PYQ's आणि अतिसंभाव्य प्रश्नांसह

- सर्व टेक्निकल विषयांचा समावेश
- सर्व विषयांचे वस्तुनिष्ठ बहुपर्यायी प्रश्न
- सर्व तांत्रिक विषयांचा समावेश
- उत्तम आकलनासाठी साध्या व सोप्या भाषेत मांडणी
- जलद उजळणी साठी उपयुक्त

पुस्तक मागणीसाठी संपर्क:

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वितरणासाठी संपर्क

अक्षरजुळणी, सजावट व मुखपृष्ठ

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Team Infinity

We Have made all possible effort to make this book error free however it is request to all students, if you find any error or want to give suggestions that we can incorporate into future editions, feel free Send us email girish@infinitycivilacademy.com

डिसक्लेमर : या पुस्तकाचे संपादन व मुद्रण करताना योग्य ती काळजी व खबरदारी घेतलेली आहे. अनावधानाने राहून गेलेल्या आणि अनावधानाने निर्माण होणाऱ्या चुकीबद्दल आम्ही दिलगिर आहोत .त्यासाठी लेखक, प्रकाशक किंवा मुद्रक यांची कुठलीही जबाबदारी नाही .संकलनातून निर्माण होणाऱ्या व त्याच्याशी संबंधित कुठल्याही प्रकारची देणी, नुकसानभरपाई यातून Infinity Publication मुक्त आहेत. सर्व पुणे न्यायालयाच्या कक्षेत



श्री स्वामी सम्पत्...

स्वामींच्या चरणी अर्पण ...

प्रस्तावना

Dear Students,,

Competitive Engineering Exams मध्ये चांगले गुण आणि टॅकसह उत्तीर्ण होणे ही एक Well Planned Process आहे. स्पर्धा परीक्षांमध्ये चांगले गुण आणि टॅक मिळवणे हे एका रात्रीत मिळू शकत नाही, हे एक झाड वाढवण्यासारखे आहे. जोपर्यंत झाड तुम्हाला आयुष्यभर फुले आणि फळे देण्याइतके चांगले वाढत नाही तोपर्यंत त्याबद्दल उत्कटतेने काम करावे लागेल.

Engineering Competitive Exams चा केवळ अभ्यासक्रम Cover करण्याऐवजी, Exam-Oriented Approach ने अभ्यास केल्याने विद्यार्थ्यांना केवळ त्यांना सोप्या वाटणाऱ्या विषयांमध्ये उत्कृष्ट कामगिरी करण्यास मदत होणार नाही तर तुलनेने अधिक कठीण विषयांमध्ये परिपूर्ण गुणही मिळतात.

WRD CEA EXAMS - संपूर्ण मार्गदर्शक देखील याच Strategy ला अनुसरून तयार करण्यात आले आहे.

उत्कृष्ट व आकर्षक मांडणी, विषयवार आणि मुद्देसूद मांडणी हे या पुस्तकाचे वैशिष्ट्य आहे. यामध्ये टेक्निकल च्या एकूण 22 विषयांचा समावेश आहे, ज्यामध्ये 1500 हून अधिक Practice Questions आणि WRD JE 2019 Exams चे Previous Year Questions ही देण्यात आले आहेत. त्यामुळे हे पुस्तक तुम्हाला WRD CEA च्या परिपूर्ण तयारीसाठी निश्चित उपयुक्त ठरेल.

आपल्या स्वप्नांचा पाठपुरावा घेण्यासाठी सज्ज व्हा. तुमच्या या प्रवासात आम्ही तुमच्यासोबत आहोत. स्पर्धा परीक्षांची तयारी करणाऱ्या सर्व परिक्षार्थ्यांना पुढील वाटचालीसाठी खूप खूप शुभेच्छा...!

सदर पुस्तकात चुका आढळल्यास 7057492418 या क्रमांकावर वॉट्स अॅप मेसेज करा.

आपला

गिरीश खेडकर

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1 MANAGEMENT

Contribution In Management Evolution

Sr	Scientist	Contribution in Management Evolution
1	Adam Smith	Economist
2	F.W. Taylor	Scientific Management
3	Frank	Time Study
4	Lillian Gilberth	Motion Study
5	Max Weber	Concept of Bureaucracy
6	Fayol Henry	Principles of Management
7	Mary Parker	Behavioral Management Theory
8	Mc Gregor	Theory X and Theory Y
9	Maslow	Need Hierarchy

Scientific Management by F. W. Taylor

Frederick Winslow Taylor

- American mechanical engineer who sought to improve industrial efficiency.
- He was one of the first management consultants.

Scientific Management Consists of :

1. Network techniques (CPM, PERT, etc.)
2. Sensitivity analysis.
3. Dynamic programming.
4. Graphical methods.

Distinguish Between Scientific Management & Traditional Management

Scientific Management	Traditional Management

1. It prefers scientific approach for selection training and placement of employees.	1. It practices recruitment and allotment of work directly to employees.
2. It works on the research and experimentation.	2. It works on trial and errors.
3. It tries to delegate work.	3. It tries to thigh work anyhow.
4. Productivity is more.	4. Productivity is less.
5. More attention on productivity.	5. More attention on production.
6. Customer gets prompt services.	6. Customer gets services which are available as per situation.

Principles of Management

Henry Fayol- is known as father of principle management.

Fourteen Principle of management.

1. Authority and Responsibility
2. Equity
3. Discipline
4. Centralization
5. Division of work
6. Subordination of individual interest to group interest
7. Initiative
8. Remuneration
9. Teamwork
10. Unity of command
11. Scalar chain

12. Unity of direction
13. Stability
14. Esprit De Corps.

Functions of Management

Major functions of management are

1. Planning
2. Organising
3. Directing
4. Controlling
5. Decision Making

2 PROJECT MANAGEMENT & NETWORK THEORY

Phases of Project Management

a. Planning

Planning involves:

1. Defining objectives of the project.
2. Listing of jobs that have to be performed.
3. Determining gross requirements for materials, equipment's and man power and preparing estimates of costs and duration for various jobs.
4. To bring about the satisfactory completion of project.

b. Scheduling

Scheduling is the allocation of resources such as time, material, space, equipment and human and technological effort.

Methods of Scheduling:

1. Bar charts or Gantt Charts
2. Milestone Charts
3. Network Analysis

c. Controlling

Controlling involves:

1. Determination of deviations from basic plan and their effects on the project.
2. Replanning and rescheduling of activities to compensate for the deviations which is called "updating".

Techniques Used For Project Management

a. Bar Chart

Firstly introduced by Henry Gantt.

Features of bar chart are:

1. It is a pictorial chart
2. It has two coordinate axes, the horizontal coordinate represents the elapsed time and vertical coordinate represents the job or activity to be performed.
3. The beginning and end of each bar represents starting and finishing time of a particular activity respectively.
4. The length of bar shows the time required for completion.

b. Mile-Stone Chart

It is a modification over original Gantt chart. Milestones are key events of main activities represented by bar.

They give idea about completion of sub-activities.

C. LINKED BAR CHART

- This is an improvement over Gantt chart or milestone chart.
- In this activities are linked with arrows and lines, specifying the sequence and order of preceding activities.

D. Network Methods

It is an outcome of the improvements in the milestone charts.

They are called by various names such as PERT, CPM, UNETICS, LESS, TOPS and SCANS.

Network Diagram And Techniques

- A network is a graphical and logical model or plan which lists out the sequence of various operations (with interdependencies) which are required to be performed for the final achievement of the project objectives
- Network diagram are of two types:
 - a. Activity-on-Arrow Network (A-O-A)
 - b. Activity on node Network (A-O-N)

Elements of a Network**Event:**

- An event is either start or completion of an activity.
- Events are significant points in a project which act as control points of the project.
- An event is an instant of time and it does not require time or resources.

Following are examples of an event:

1. All parts assembled
 2. A budget prepared
- Events are represented by nodes in a network.
 - Most commonly adopted shape for events is circular shape.



(i) Circular (ii) Square (iii) Rectangular (iv) Oval

1. Tail event or the start event:

- It makes the beginning of an activity.
- If it is the first event of project then known as "initial as start event". It has only outgoing arrow.

2. Head event or the final event:

- The event which marks the completion of an activity is known as "head event".
- It has only incoming arrows.

3. Dual role events:

- All events except the first and the last event of a project are dual role events.
- They have both incoming and outgoing arrows.

4. Predecessor events:

- The event or events that occur before another event are called predecessor event to that event.

5. Successor events:

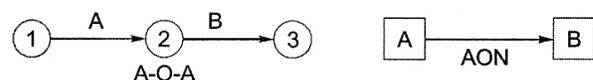
- The event or events that follow another event are called successor events to that event.

Activity

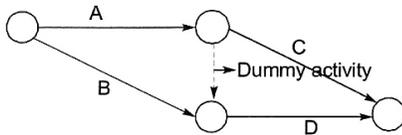
- Any portion of a project which consumes time or resources and has a definite beginning and an end is called as an activity.
- An activity is denoted by an arrow. Length of the arrow has no significance.
- Activity is actual performance of a job. It requires time and resources for its completion.

Following are examples of an activity:

1. Excavating trench
2. Mixing concrete
3. Preparing budget

**Dummy**

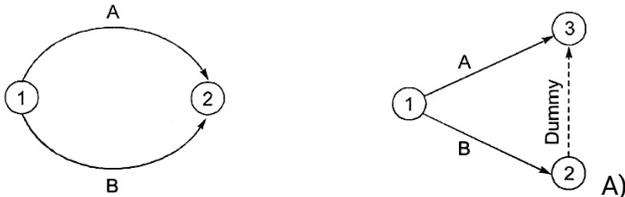
- A dummy is a type of operation which neither requires time nor any resource, but it denotes dependency among the activities.
- It is represented by dashed arrow.
- In the figure shown below, a dummy activity is shown.



Dummy is used to serve following purposes:

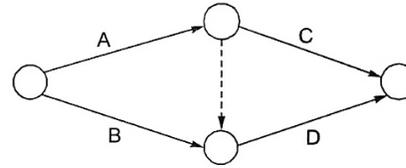
1. Grammatical purpose:

To prevent two arrows having common beginning and common end.



Ambiguous representation. b) Grammatically clean Representation

2. **Logical purpose:** To show relationship with other activities.



Fulkerson's rule for numbering the events:

1. The single initial event is numbered as 0, 1, 10 etc.
2. All arrows emerging out of the initial event are neglected. Doing so, the created one or more new initial events are numbered as 2, 3, 4 or 20, 30, 40 etc.
3. Step - 2 is repeated unless all events are numbered.

Errors in Network

1. Looping error
2. Dangling error
3. Wagon wheel error

3 PERT AND CPM

PERT – (Programme Evaluation And Review Technique)

- It was developed by the U.S. Navy.
- It is an event **oriented network**.
- Cost is assumed to be directly proportional to time.

Three time estimates are made in PERT:

1. **Optimistic time (t_0):** This is the minimum possible time in which an activity can be completed under the most ideal conditions
2. **Pessimistic time (t_p):** This is the maximum time required to complete an activity under the worst possible conditions.
3. **Most likely time (t_m):** This is the time required to complete an activity under normal working conditions. Its value lies between t_0 and t_p . It is near to the expected time.

Mean Time or Expected Time Or Average Time

- In PERT each activity is assumed to follow β - distribution curve of time.
- Value of expected time is calculated by weighted average as,

$$t_e = \frac{t_0 + 4t_m + t_p}{6}$$

Standard Deviation of An Activity (σ)

- This is the measurement of uncertainty, which is approximately one sixth of time range i.e.

$$\sigma = \frac{t_p - t_0}{6}$$

Variance of an Activity (σ^2)

- Square of standard deviation is variance of an activity.

FLUID MACHINES

1. FLUID MACHINES

Introduction

- In hydraulic machine the energy of fluid is transfer to rotor or energy of rotor is transfer to fluid while the fluid moves or flow through the machine.
- Force caused by moving fluid due to rate of change of momentum
- The magnitude and direction of the force can be determined by using impulse momentum principle.
- According to impulse moment principle
- Momentum = mass x Velocity.
- According to newton's second law of motion:
- Applied force = Rate of change of momentum.
- $F = \frac{d}{dt} (mv)$
- $F = m \frac{dv}{dt} = ma$
- We can also write ,
- $F = \frac{m}{t} (v_2 - v_1)$
- Product of F and t is also called as impulse.
- Here $\frac{m}{t}$ is mass flow rate of a fluid and can also be written as $\frac{m}{t} = \rho Q$
- Therefore
- $F = \rho Q (v_2 - v_1)$
- This is the equation for the force exerted by machine on fluid. Force exerted by fluid on machine can be written as
- $F = \rho Q (v_1 - v_2)$

Force due to impact of jet on plate

Assumptions:

1. Plate is perfectly smooth.
2. Friction between plate and jet is negligible.
3. There is no loss of energy during impact of jet.
4. Velocity of jet is uniform throughout.

Jet Strikes Normal to the Flat Stationary Plate

S

Fig 1.1. Fluid jet striking stationary vertical plate

Force exerted by the jet normal to the plate

$$P_n = \rho a V^2 \dots (1)$$

Where

$$a = \text{area of jet}$$

$$V = \text{velocity of jet}$$

Jet strikes on an inclined stationary plate

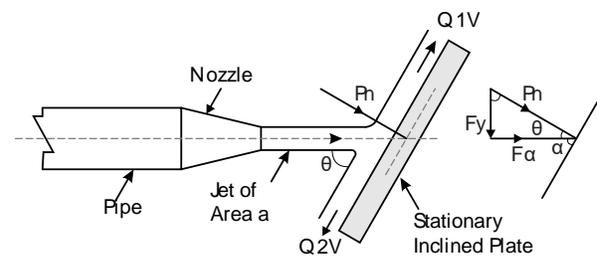


Figure 1.2 Fluid Jet Striking Stationary Inclined Plate

Force exerted by the jet normal to the plate

$$P_n = \rho a V^2 \sin \theta \dots (2)$$

$$Q_1 = \frac{Q}{2} [1 + \cos \theta] \dots (3)$$

$$Q_2 = \frac{Q}{2} [1 - \cos \theta] \dots (4)$$

$$\frac{Q_1}{Q_2} = \frac{1 + \cos \theta}{1 - \cos \theta} \dots (5)$$

where

Q_1 and Q_2 are discharge following in the two directions

Force Exerted By Jet on Moving Flat Plate Normal To Jet

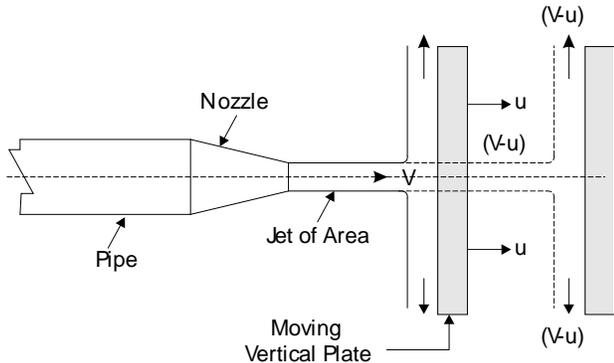


Figure 1.3 Fluid Jet Striking Moving Flat Plate

$u = \text{plate velocity}$

$$P_n = \rho a(V - u)^2 \dots (6)$$

Work done per second

$$(W) = P_n \times u = \rho a[V - u]^2 \times u \dots (7)$$

jet striking on a symmetrical stationary curved plate

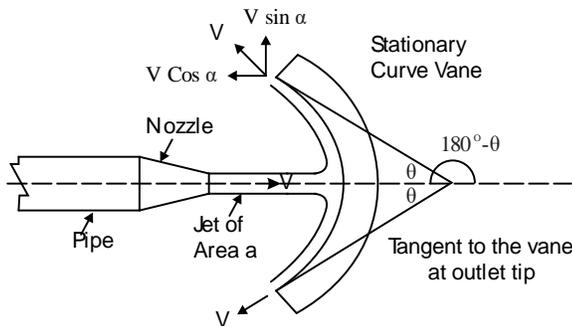
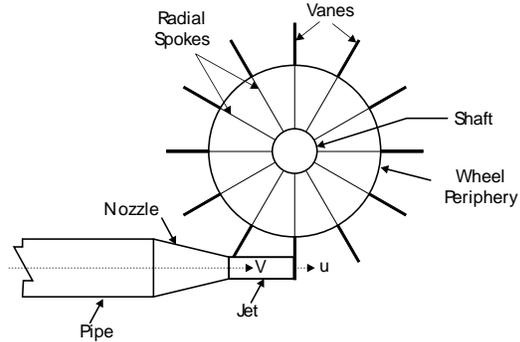


Figure 1.5 jet striking a stationary symmetrical curved vanes at its curvature

$$P_n = \rho aV^2(1 + \cos\theta) \dots (8)$$

- Force exerted by a jet in its direction of flow on a curved vane is always greater than that exerted on a flat plate.

Jet strikes on series of flat plate mounted on the periphery of wheel



$$P_n = \rho aV(V - u)$$

Figure 1.4 Flat Plates Mounted On The Periphery of A Wheel

Work done by the jet

$$= P_n \times u$$

$$W = \rho aV(V - u)u$$

Efficiency of the work done of wheel

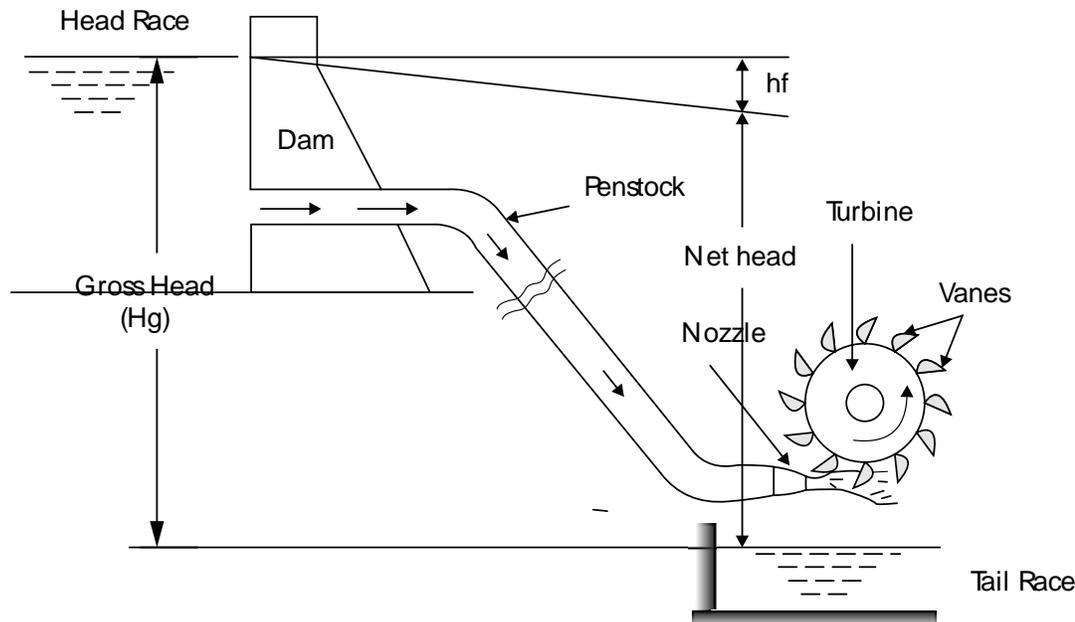
$$\eta = \frac{2u(V - u)}{V^2} \dots (9)$$

At, $u = \frac{V}{2}$; $\eta_{max} = 50\%$

2. HYDRAULIC TURBINE

- Turbines are hydraulic machines which convert hydraulic energy into mechanical energy.

Layout of Hydro Power Plant



- **Penstock** is a pipe of large diameter which carry water under pressure from storage reservoir to the turbine chamber.
- **Surge Tank** is an open operation tank provided in midway of Penstock to absorb water pressure hammer during sudden stoppage of flow in the turbines. It should be located as near to turbine as possible.

Definitions :-

1. Gross Head :-
 - It is the difference between the head race level and tail race level. It is denoted by 'H_g'.
2. Net Head :-
 - It is also called effective head
 - It is defined as the head available at the inlet of the turbine. When water is flowing from head race

to the turbine, a loss of head due to friction between the water and penstocks occurs.

$$H = h_g - h_f$$

Where,

$$h_f = \frac{4fLV^2}{2gD}$$

V = Velocity of flow in penstock,

L = Length of penstock,

D = Diameter of penstock

Efficiencies of a Turbines :

1. Hydraulic Efficiency (η_h) :-

- It is defined as the ratio of power given by water to the runner of a turbine to the power supplied by the water at the inlet of the turbine.

$$\eta_h = \frac{\text{Power delivered to runner}}{\text{Power supplied at inlet}} = \frac{R.P}{W.P}$$

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- स्पर्धा परीक्षेमधील 7 वर्षांहून अधिक अग्रगण्य नाव
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स्थापत्य / विद्युत / यांत्रिकी साठी
पूर्व + मुख्य + मुलाखत या तिन्ही टप्प्याची तयारी करवून घेणारी
महाराष्ट्रातील नं 1 अकॅडमी
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महाराष्ट्र शासनामधील विविध विभागातील होणाऱ्या सरळसेवा भरती परीक्षांची तयारी करून घेणारी संस्था. कनिष्ठ अभियंता / अभियांत्रिकी सहाय्यक / नगर रचनाकार सहाय्यक या परीक्षांसाठी (टेक्निकल + नॉन टेक्निकल) विषय तज्ञ अनुभवी मार्गदर्शकांकडून शिकवले जातात.



सर्व स्पर्धा परीक्षेची तयारी करवून घेण्यासाठी इन्फिनिटी अकॅडमी मध्ये तज्ञ शिक्षक वर्ग आहेत.

विविध विषयासाठी (टेक्निकल + नॉन टेक्निकल) DEDICATED अनुभवी शिक्षक वर्ग असल्यामुळे स्पर्धा परीक्षेतील प्रत्येक विषयाला योग्य न्याय दिला जातो व तो विषय उत्तमप्रकारे शिकवले जातो.

विद्यार्थ्यांची स्पर्धा परीक्षेमार्फत शासनात निवड हे एकमेव ध्येय इन्फिनिटीच्या अनुभवी शिक्षकांचे आहे

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MES RANK 1 MECHANICAL



PRATIK AGAWANE



MES RANK 1 ELECTRICAL



SANKET SHINDE



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