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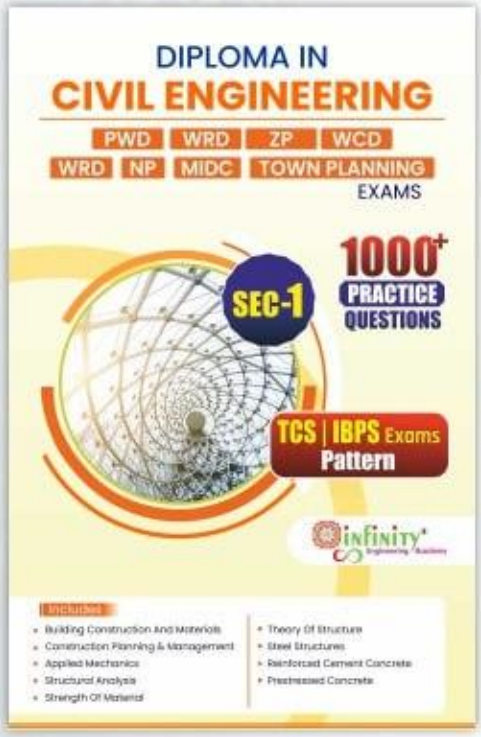

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श्री स्वामी समर्थ...

स्वामींच्या चरणी अर्पण ...

PREFACE

We are extremely happy to present perfect Book Set for Diploma and Degree aspirants, those are preparing for All Direct Recruitment Examinations such as PWD, WRD, MIDC, ZP, Nagar Parishad and all other departments. This is first section out of three sections of Diploma set.

This section covers most important 9 structure and numerical based technical subjects.

This section covers theory concepts and more than 1000 practice questions which are strictly as per latest TCS/IBPS pattern.

This book set is useful tool for All Direct Recruitment Examination for posts like Junior Engineer as well as Civil Engineering Assistant. The subjects are in proper manner so that topics are understood properly.

Number of MCQs are included so, we are sure that this book will cater all your needs to grab the post.

We are thankful to our Publication department, Graphic designers for encouragement and support that they have extended. We are also thankful to director and staff members of infinity academy for their efforts to make this book as good as it is.

We have jointly made every possible efforts to make this book error free, However if you find if any please let us know at 7057492418, because that will help us to improve us further.

GIRISH KHEDKAR

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1 Cement

Introduction

A mixture of silicates and aluminates of calcium that when mixed with water it binds a stone-sand mixture into a strong concrete within a few days. The manufacture of cement involves three distinct operations as shown

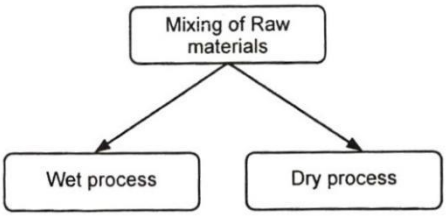

Fig. 1.1

Mixing of Raw materials → Burning → Grinding

Mixing of Raw Materials

The raw materials used in the manufacture of cement are :

(a) Argillaceous material consisting of silicates of alumina in the form of clays and shales.

(b) Calcareous materials - in the form of limestone, chalk and marl, which is mixture of clay and calcium carbonate. These materials are mixed thoroughly.

Wet Process

In the earlier part of the century i.e. from 1913 to 1960, the wet process was popular for the manufacture of cement. This was because of the possibility of more accurate control in mixing of the raw materials. The techniques of intimate mixing of raw materials were not available then. Later, with the development of the technique of dry mixing of powdered materials using compressed air, the dry process gained momentum.

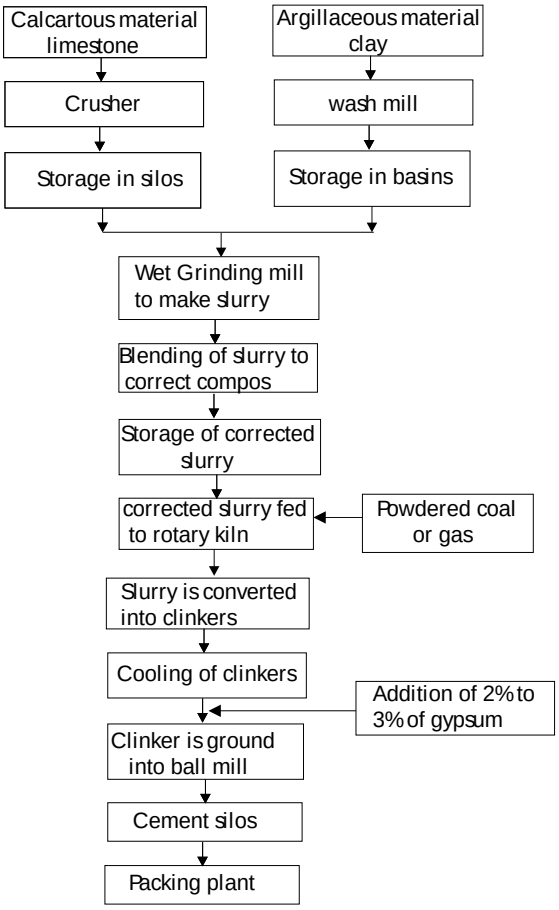

Fig . 1.2 Wet Process of Cement Manufacturing

The dry process requires much less fuel as the materials are already in a dry state, whereas in the wet process the slurry contains 35% to 50% water. To dry the slurry, more fuel is required. In the wet process, the calcareous materials such as limestone are crushed and stored in silos or, storage tanks. The agrillaceous material such as clay is thoroughly mixed with water in a wash mill. The washed clay is then stored in basins. Now, the crushed limestone from the silos and wet clay from basins are mixed together in a wet grinding mill to make slurry. The slurry is led to the correcting basin where it is constantly stirred. At this stage, the chemical composition of the slurry is tested and adjusted as necessary. The corrected slurry is stored in storage tanks end kept ready to serve as feed for a rotary kiln.

Dry Process

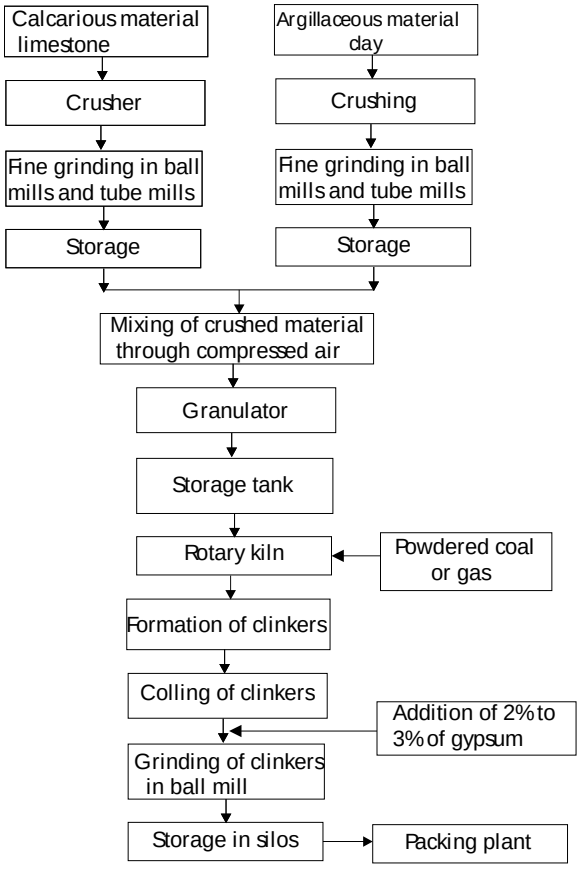

Fig.1.3 Dry Process Of Cement Manufacturing

The boulders of limestones upto 1.2 m size are transported in huge dumpers and dumped into the hoopers of the crusher. The limestone is now crushed to a size of75 mm. The crushed limestone is moved from the crusher by a series of conveyors for stacking. The argillaceous material is also crushed and stacked like the limestone. The crushed materials are checked for calcium carbonate, lime, alumina, ferrous oxide and silica contents. Any material found short, is added separately. The materials are then ground to the desired degree of fineness. The dry powder, called the raw meal, is then further blended and corrected for its right composition and mixed by means of compressed air.

The aerated powder tends to behave almost like liquid and in about one hour of aeration, a uniform mixture is obtained. The blended meal is further sieved and feed into a rotating disc called granulator. A small quantity of water, about 12% by weight, is added to make the blended meal into pellets. This is done to permit air flow for exchange of heat for further chemical reactions and conversion for the same into clinkers in the rotary kiln.

Burning

Burning is carried out in a rotary kiln.

In the dry process, coal brought from coal fields is pulverised in vertical coal mill and is stored in silo. It is pumped with required quantity of air through the burners. The preheated raw materials roll down the kiln and get heated to such extent that carbon-dioxide is expelled along with other combustion gases. The material is then heated to a temperature of 1400°C to 1500°C and the formation of clinckers take place.

Grinding

The clinkers, so obtained from the rotary kiln, are ground to the required degree of fineness in a ball mill or a tube mill. During grinding, a small quantity of gypsum about (3% to 4%) is added.

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1 Management

Various Definitions of Management

- The word management is derived from a Latin word 'mantis'. Manus means a driver controlling a team of horses pulling a cart. But later on many thinkers put up the definition of 'management' in different ways.
  1. **Henry Fayol -** "To forecast and plan, to organise, to command, to co-ordinate and to control is called as management."
  2. **Blanchard -** "Management is working through individuals and groups to accomplish organisational goals."
  3. **Mescon -** "Management is the process of planning, organising, leading and controlling the efforts of organisation members and of using all organisational resources to achieve stated organisation goals."
  4. **Mary Parker - "**It is getting things done by others."
  5. **Robinson -** "Management is the process of optimising human, material and financial contributions for the achievement of organisational goals."
  6. **Drucker -** "The systematic organisation of economic resources." (a) **Management as an Economic Resource :**
- The simplest definition of management is the "achievement of objectives through the efforts of other people

Contribution In Management Evolution

- Many thinkers, scientists related to management contributed in the evolution of management science all the time.

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

- (March 20, 1856 – March 21, 1915) was an American mechanical engineer who sought to improve industrial efficiency. He was one of the first management consultants.

- Taylor was one of the intellectual leaders of the Efficiency Movement and his ideas, broadly conceived, were highly influential in the Progressive Era (1890s-1920s). Taylor summed up his efficiency techniques in his 1911 book *The Principles of Scientific Management*, which in 2001 Fellows of the Academy of Management

voted the most influential management book of the twentieth century His pioneering work in applying engineering principles to the work done on the factory floor was instrumental in the creation and development of the branch of engineering that is now known as industrial engineering.

- Taylor made his name in, and was most proud of his work in, scientific management; however, he made his fortune patenting steel-process improvements. Taylor was also an athlete who competed nationally in tennis and golf.

Scientific Management By F. W. Taylor

1. **F.W. Taylor** is known to us as the 'Father of Scientific Management'.
2. Scientific Management distinguishes the progressive management practices from the traditional systems of management.
3. Scientific management developed ways for solving problems which are very impossible for the ordinary managerial processes.
4. Its methodology was based on careful investigation of every operating problems in the industrial world.
5. It started applying scientific methods of research to managerial problems.
6. Scientific management established a philosophy of a correct mental attitude with effective problem solving logic.
7. Use of computers is also involved in today's scientific management practices.
8. Mathematical models and Operation Research concepts help in solving very difficult and complicated problems. This is a great evolution in scientific management.

Scientific Management Consists of :

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

Advantages of Scientific Management:

1. It helps in getting relevant information in proper time for planning the job.Plan prepared is more realistic.
2. Idle time is reduced effectively, hence completion of job is possible within given time.
3. It helps in getting suitable man and machine for the given work.
4. Effective assignment is possible avoiding overlapping or idle situations.
5. It directs best method for doing the work.
6. Waiting time and material wastage is reduced.
7. It takes due care of safety applications, health administration and working conditions on shop floor.
8. It utilises most update quality approaches.
9. Human factor is considered at every stage.
10. Cordial relations are maintained.
11. Unnecessary delays are avoided.
12. Cost reduction is possible.

In this way Scientific management is a vital tool of management which works at only one goal "DOING THE BEST.

Handling Complexity:

Manager has to solve each and every complex problem. Many times problem has number of parameters which makes it serious in nature. Considering all parameters from different angles, their effect on the system, ways to reduce them, getting the solution, is quite tough task. Using scientific management these complex problems can be tackled easily. Complexity is solved using numerical formulae, analytical methods or different mathematical models. Solving any problem which is not complex is possible by management but complex problem is solved by scientific management principles only.

Optimization :

The process of obtaining the best possible output is known as optimization. Optimization may be maximum or minimum.

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Highway Engineering

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1 Highway Development & Planning

1.1 Order of road development

1. Roman Roads:-
- Roman started 1st time construction of roads in large scale, In 312 BC.
  - They constructed Appian way of length over 580Km.
2. Indian Roads:-
  - Indus Valley Civilization [5000 BC] Town are planned with grid pattern.
  - Mouryans [4000 to 2000 BC] Chandra Gupta Mourya constructed 2400Km long road from Pataliputra [Patna] to Takhashila [now in Pakistan].
  - First British road-GT road from Calcutta to Delhi Grand trunk Road was consrructed during 1540 to 1545 AD.
3. Tresaguest Construction :- [France1757-1834]
  - "Pierre tresaguest" developed roads in France during 1764 AD-introduce camber for drainage of surface water.
4. Metcalf Construction :-[England]-[1717-1810]
5. Telford Construction :-[England]-[1757-1834]
  - His work started in early 19th century in England.
6. Macadam Construction :-[1756-1836]
  - The first method based on scientific thinking.
  - The importance of subgrade draining and compact was recognized and cross slope of 1 in 36 we proposed from subgrade level itself.

1.2 Modern Road Development in India:-

Jayakar Committee

- [Indian Road Development Committee]-1927 recommendations:-
- After the First World War motor vehicles using the roads increased. So the existing roads when not capable to withstand the mixed traffic conditions. [bullock cart & motor vehicle traffic]. To solve this problem Indian Road Development Committee was appointed under M.R. Jayakar as chairman in 1927.

Recommendation:-

1. Road Development in the country should be consider as a National interest.
2. An extra tax should be levied on patrol from the road users to develop a road development. Fund called "Central Road Fund".
3. A semi official technical body should formed to pool the technical know-how and act as advisory body.
4. A research organization should be instituted to carry a research of development work.

Accepted Jayakar Committee recommendation:-

1. The Central Road Fund formed in 1929.
2. A semi official technical body known as Indian Road Congress-1934
3. Motor vehicle act started-1939
4. Central Road research Institute started-in 1950. Located in New Delhi.

   C.R.R.I is controlled by Shipping & Transport Ministry.

   The Central Road Organization [C.R.O] was set up in 1930
5. National Highway Act-1956

   The responsibility of development and maintenance of National Highway lies with Central Govt.

   The Border Roads Development Board—1960 under PM.
6. Highway Research Board of IRC-1973

To give proper direction and guidance to road research activities in India

7. National Transport Policy Committee in 1978
8. National Highway Authority of India [1995]

Indian road Congress [IRC]-1934:-

- Headquarter of IRC at New Delhi
- A semi-official technical body of Central Govt.
- It publishes various codes standardizing the specifications
- The IRC has played important role in the formulation of the three 20 years road development plan in India.
- The technical activities of the IRC are mainly carried out by highway research board and several committees.

1.3 Road development plan:-

1] First 20 years Road development Plan [Nagpur Road Plan]:- 1943-1963

The Nagpur Road Plan prepared on the basis of "star and grid Pattern".

The roads were divided into four classes:

A. National highways which would pass through states, and places having national importance for strategic, administrative and other purposes.

B. State highways which would be the other main roads of a state,

C. District roads which would take traffic from the main roads to the interior of the district According ID the importance. Some are considered as major district roads.

D. Village roads which would link the villages to the road system.

- The total length of 5,32,700 km with a density of about 16km of road length per $100km^2$ area.
- The length of the railway tracks in the area was considered within the road length. Hence net road length is calculated by subtracting length of railway track from the length of metalled road.
- The target road length was nearly completed earlier in 1961

Result:-

Through the total achievement was higher than the targeted value but the lengths of NH & SH achieved were lesser than the plan targets.

2] Second Road Development Plan [Bombay Road Plan]:- [1961-1981]

- The target of this plan is to provide total road length of 32km per $100km^2$ area.
- Maximum distance of any place in a developed or agricultural area would be 6.4 km from a mettalled road and 2.4 km from any category of roads.
- Every town with a population above 2000 in plains & above 1000 in semi-hill areas & above 500 in hilly areas should be connected by metalled road.
- Expressways considered in this plan
- 1600 km of length within proposed target in NH.
- Overall road length=10,57,330km
- Length of railway track is considered independent of the road system & hence it is not subtracted to get the road length.
- A development factor of 5% is provided for future development
- Cost of plan 5200 crores Rs.
- ***Result***:-

  The total achievement was higher than targeted but NH & SH were constructed lesser than targeted.

  It should be noted that allowance for development of agriculture & industry during the next 20years was made in Nagpur Plan allowing 15% increase in the calculated road length this allowance according to the second plan is 5% only.

Compare Nagpur & Bombay Plan:-

- Nagpur road plan divided the area into two part

  a] Agricultural &

  b] Non-Agricultural area

- In Bombay Road plan area divide into three part

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1 ESTIMATION & COSTING

What is an Estimate?

- An estimate for any construction work may be defined as the process of calculating the quantities and costs of the various items required in connection with the work.
- It is prepared by calculating the quantities, from the dimensions on the drawings for the various items required to complete the project and multiplied by unit cost of the item concerned.
- To prepare an estimate, drawings consisting of the plan, the elevation and the sections through important points, along with a detailed specification giving specific description of all workmanship, properties and proportion of materials, are required.

Purpose of Estimating:-

Estimate for a work or project is necessary mainly for the following purposes:-

1. To ascertain the necessary amount of money required by the owner to complete the proposed work. For public construction works, estimates are required in order to obtain administrative approval, allotment of funds and technical sanction
2. To ascertain quantities of materials required in order of programme their timely procurement. to procure controlled materials, if any, like cement, steel, etc:; quantities of such materials are worked out from the estimate of the work and attached with the application for verification.
3. To calculate the number of different categories of workers that are to be employed to complete the work within the scheduled time of completion.
4. To assess the requirements of Tools, Plants and equipment required to complete the work according to the programme.
5. To fix up the completion period from the volume of works involved in the estimate.
6. To draw up a construction schedule and programme and also to arrange the funds required according to the programming.
7. To justify the investment from benefit cost ratio. (For ideal investment, this ratio should be more than one).
8. To invite tenders and prepare bills for payment.
9. An estimate for an existing property is required for valuation.

Different Types of Estimates :-

There are different types of estimates and they are as follows:

A Detailed Estimate: -

- This includes the detailed particulars for the quantities, rates and costs of all the items involved for satisfactory completion of a project.
- Quantities of all items of work are calculated from their respective dimensions on the drawings on a measurement sheet.
- Multiplying these quantities by their respective rates in a separate sheet, the cost of all items of work are worked out individually and then

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1 Water Demand

CHAPTER 1 WATER DEMAND

1.1 Water Demand

- Estimation of demand for water is the key parameter in planning a water supply scheme. The agriculture sector consumes more than 80 percent of total water potential created in our country. The remaining portion is utilized to meet domestic, industrial and other demands.
- The improvement in life-style and associated industrial development of a nation push up the per capita demand for water.

1.2 Various Types of Water Demand

- There are different types of water demands According to code IS 1172-1997.

1. Domestic water demand

Domestic water demand includes the water required in private building for drinking, cooking, bathing, gardening purposes etc. which may vary according to the living conditions of the consumers.

- The total domestic water consumption is near about 50 to 60% of the total water consumptions.
- The IS code caps a limit on domestic water consumption between 135 to 225 $lpcd$.
- As per IS code, the minimum domestic water demand under ordinary conditions for a town with full flushing system should be taken as 200 $lpcd$ although it can be minimized upto 135 $lpcd$ for economically weaker section and LIG colonies (low income group) depending upon prevailing conditions.

2. Industrial Water Demand

- The industrial water demand expresses the water required for industries. Which are either existing or are likely to be started in future, in the city for which water supply is being planned.
- This water requirement will thus vary with the types and number of industries present in the city.
- In industrial cities, the per capita requirement may finally be computed to be as high as 450 $l/h/d$ as compared to the normal industrial requirement of $50\ l/h/d$.

Table: Water Requirements for Commercial Buildings (as per IS code)

Type of building	Avg consumption in $(lpcd)$
Factories	
(a) Where bathrooms are required to be provided	45
(b) Where no bathrooms are required	30
Hospitals (Including laundry, per bed)	
(a) Number of beds less than 100	340
(b) Number of beds exceeding 100	450
Nurses homes and medical quarters	150
Hostels	135
Hotels (per bed)	180
Restaurants (per seat)	70
Offices	45

Cinemas, auditoriums and theatres (per seat)	15
Schools (a) Day scholars (b) Residentials	 45 135

3. Institutional and Commercial Water demand

- On an average, a per capita demand of $20\ l/h/d$ is usually considered to be enough to meet of such commercial and institutional water requirements although of course, this demand may be as high as $50\ l/h/d$ for highly commercial cities.

4. Demand for Public Uses

- This includes water requirement for parks, gardening, washing of roads etc.
- A nominal amount, not exceeding 5% of the total consumption may be provided to meet this demand.

5. Fire Demand

- The quantity of water required for extinguishing fire is not very large.
- For a total amount of water consumption for a city of 50 lakhs population, it hardly amounts to 1 $lpcd$ of fire demand, but this water should be easily available and kept always stored in storage reservoirs, as quantity of water required is in very less duration.
- Following requirements must be met for the fire demand:
- The minimum water pressure available at fire hydrants should be of the order of $100\ to\ 150\ kN/m^2$ (10 to 15 m of water head) and should be maintained for 4 to 5 hours of constant use of fire hydrant.
- The jet streams are simultaneously thrown from each hydrants; one on the burning property and one each on the adjacent property on either side of the burning property.
- The discharge of each stream should be about $1100\ l/min$.
- The number of fire jets required depend on the size of population and given by $F = 2.8\sqrt{P}$, where, P = Population in thousands.

Calculation of Fire Demand:

- For cities having population exceeding 50,000, the water required in kilo litre may be computed using the relation Kilo litre of water required = $100\sqrt{P}\ where, P$ = Population in thousand.

1. Kuchling's Formula: It states that

$$Q = 3182\sqrt{P}$$

Q = Amount of water required in litre/minute

P = Population in thousands.

2. Freeman's Formula : It states that

$$Q = 1136\left[\frac{P}{5} + 10\right]$$

3. Buston's Formula : It states that,

$$Q = 5663\sqrt{P}.$$

1.3 Per Capita Demand (q):

Per capita demand is the annual average of daily water required by one person which includes the all demands explained above.

$$q = \frac{\text{Total amount of water supplied to city throughout the year}}{365 \times \text{population Served}}$$

Factors Affecting Per Capita Demand

Use	Demand in $l/h/d$
(i) Domestic Use	200 (60%)
(ii) Industrial Use	50
(iii) Commercial Use	20
(iv) Public Use	10
(v) Waste & theft	55
(vi) Fire demand	< 1
	Total = 335 Per Capita Demand (q)

Table: Break up for per capita demand (q) for an average Indian City

1.4 Fluctuation in Demand

1. Maximum daily demand = 1.8 x q

7 Approach Facilities

SHAPE OF GATES:

The shape of gates in plan has an important bearing on the strength of gates. Gates are usually straight or curved.

The straight gate is subjected to forces as discussed previously and have to be designed accordingly.

The curved gate is strong against the transverse water pressure and on account of the arched shape, the transverse stress gets decreased as the curvature increases and the two gates together forma circular arch, when the transverse stress is completely changed to longitudinal compression. Thus, the stress becomes wholly compressive. This, of course, varies with the depth of the gate, as the section of the gate at the bottom gets maximum compressive stress.

These gates are theoretically the best type. But such gates have the following drawbacks:

(i) They are longer and costlier.

(ii) They require large gate recesses,

(iii) The gate sills will have to be curved, which is difficult and costly to construct. So, as a compromise, gates with a small curvature on the inside and with a straight sill are constructed.

WORKING OF GATES:

The gates are usually opened and closed, by two sets of chains, one for opening and the other for closing and operated simultaneously. These chains are fastened to each gate at one-third its height on both sides, near the free end. Various hydraulic mechanical devices have also been adopted for this purpose at the large docks. For small boat canal gates, the lock gates can be operated by hand.

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मराठी मुळाक्षरे / वर्णमाला

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य र ल व श ष स ह ळ क्ष ज्ञ

वर्णमालेविषयी महत्वाचे

1) मूळ वर्णमालेतील वर्णांची संख्या 48 होती तर आधुनिक वर्णमालेत ती 52 आहे.

2) ऋ, ऌ या स्वरांचा चौदाखडीत समावेश होत नाही.

3) 'अँ, आँ' यांचा पाठ्यपुस्तकात स्वर असा उल्लेख आहे; म्हणून उत्तरसुद्धा स्वर असेच द्यावे.

4) 'र' या वर्णाचा उच्चार करताना कंपन होते; म्हणून त्याला 'कंपित वर्ण' म्हणतात.

5) शब्दाच्या शेवटी येणाऱ्या व्यंजनाचा पाय मोडलेला असेल तर त्याला व्यंजनान्त म्हणतात, जर पाय मोडलेला नसेल तर त्याला स्वरान्त म्हणतात.

6) शेवटी स्वतंत्र उभा दंड असलेले वर्ण - श्, ण, ग् ----

7) मध्ये उभा दंड - क्, फं ----..

8) उभ्या दंडाला जोडलेले - न्, त् ----

9) अर्धा उभा दंड - ट्, ड् ----

10) कोणताही दंड नसलेले वर्ण - र्

वर्णांचे वर्गीकरण

1) स्वर:- ओठांचा एकमेकांशी किंवा जिभेचा मुखातील कोणत्याही भागाशी स्पर्श न होता तोंडावाटे जे ध्वनी बाहेर पडतात, त्यांना स्वर असे म्हणतात.

स्वर स्वतंत्र उच्चाराचे असतात.

स्वरांचे खालीलप्रमाणे प्रकार पडतात :

अ) ह्रस्व स्वर :-

अ, इ, उ, ऋ, ऌ ' या स्वरांचा उच्चार आखूड होतो, म्हणजे उच्चार करावयास कमी कालावधी लागतो; म्हणून त्यांना ह्रस्व स्वर म्हणतात.

' ऋ ' हा स्वर व्यंजनात मिसळल्यास त्या व्यंजनात दर्शविल्याप्रमाणे बदल होतो. क + ऋ= कृ

ब) दीर्घ स्वर :-

'आ, ई, ऊ' या स्वरांचा उच्चार करण्यासाठी जास्त कालावधी लागतो म्हणजेच लांबट उच्चार होतो; म्हणून त्यांना दीर्घ स्वर म्हणतात.

क) संयुक्त स्वर :-

'ए, ऐ, ओ, औ' हे स्वर इतर दोन स्वरांचे मिळून बनल्याने त्यांना संयुक्त स्वर म्हणतात. संयुक्त स्वर दीर्घ उच्चाराचे असतात.

उदा : 1) ए = अ + इ/ ई 2) ऐ = आ + इ / ई

3) ओ = अ + उ / ऊ 4) औ = आ + उ / ऊ

याशिवाय स्वरांचे सजातीय स्वर व विजातीय स्वर असे उच्चार स्थानांवरून दोन प्रकार पडतात.

1) सजातीय स्वर : तोच स्वर ह्रस्व किंवा दीर्घ पुन्हा आल्यास सजातीय स्वरांची जोडी तयार होते. संयुक्त स्वरांचा सजातीय स्वरांमध्ये समावेश होत नाही. एकाच उच्चार स्थानांतून निघणाऱ्या स्वरांना सजातीय स्वर असे म्हणतात.

उदा : 1) अ – आ 2) इ-ई

3) उ-ऊ

टीप : पूर्वी ऋ-ॠ, ल- ऌ यांचासुद्धा सजातीय स्वरामध्ये समावेश केला जात होता; परंतु आता यातील दीर्घ स्वर जवळजवळ वापरात नाहीत.

2) विजातीय स्वर : तोच स्वर ह्रस्व किंवा दीर्घ पुन्हा न येता दुसराच स्वर आल्यास विजातीय स्वरांची जोडी तयार होते. भिन्न उच्चार स्थानांतून निघणाऱ्या स्वरांना 'विजातीय स्वर' असे म्हणतात. ए, ऐ, ओ, औ या संयुक्त स्वरात सजातीयत्व नाही कारण ते मुळातच विजातीय स्वरोत्पन्न आहेत.

उदा: 1) अ-इ 2) अ – उ 3) उ-ई 4) इ-ऊ

सजातीय व विजातीय स्वरांविषयी महत्त्वाचे :

1) दोन सजातीय स्वरांपासून एकच दीर्घ स्वर तयार होतो.

2) दोन विजातीय स्वर एकत्र आल्यास संयुक्त स्वर तयार होतो.

3) दोन संयुक्त स्वर एकमेकांत मिसळत नाहीत.

2) स्वरादी: 'अं व अः' अनुस्वार व विसर्ग या दोन वर्णांचा उच्चार करण्यापूर्वी एखाद्या स्वराचा उच्चार करावाच लागतो, म्हणून ज्याच्या आधी स्वर आहे त्याला स्वरादी असे म्हणतात.

3) व्यंजने :

1) वर्णमालेत एकूण 36 व्यंजने आहेत.

2) उच्चार करताना जिभेचा तोंडातील इतर अवयवांना स्पर्श तसेच हवेचा मार्ग अडवून शेवटी स्वरांचे साहाय्य घ्यावे लागणाऱ्या प्रत्येक वर्णाचा व्यंजनात समावेश होतो.

3) व्यंजनांचा उच्चार पूर्ण/स्पष्ट करण्यासाठी शेवटी स्वराचे साहाय्य घ्यावे लागते; म्हणून त्यांना‘ “स्वरान्त” ‘असेसुद्धा म्हणतात.

4) व्यंजने ही अपूर्ण उच्चारांची असल्याने त्यांचा पाय मोडून लिहितात, त्यात स्वर मिळवल्यास मात्र ती पाय मोडून लिहिली जात नाहीत.

5) उच्चार पूर्ण होण्यासाठी व्यंजने स्वरांवर अवलंबून असतात; म्हणून त्यांना 'परवर्ण' म्हणतात.

6) व्यंजनांना अक्षरत्व येण्यासाठी व्यंजनात स्वर मिसळणे गरजेचे असते.

7) आखूड / तोकड्या उच्चाराला निभृत उच्चार म्हणतात.

8) व्यंजनात स्वर मिळवला,की अक्षर बनते.

i) स्पर्श व्यंजने :-

स्पर्श व्यंजने एकूण 25 आहेत, त्यांची खालील गटांत विभागणी होते.

अ) कठोर व्यंजने :-

'क्, ख्, च्, छ, ट, ठ, त्, थ्, प, फ्' यांचा उच्चार करावयास कठीण असल्यामुळे त्यांना “कठोर व्यंजने” म्हणतात.

श, ष, स् या वर्णाचाही कठोर वर्णात समावेश होतो. कठोर व्यंजनांना 'श्वास' किंवा 'अघोष' वर्ण म्हणतात. एकूण कठोर व्यंजने 13 आहेत.

ब) मृदू व्यंजने :-

“ग्,घ्,ज्,झ्,ड्,ढ,द्,ध,ब,भ”या व्यंजनांचा उच्चार करावयास सोपा असल्यामुळे त्यांना मृदू व्यंजने म्हणतात.

य, र, ल, व, ह, ळ तसेच सर्व स्वर, स्वरादी, अनुनासिके या वर्णांचासुद्धा मृदू वर्णात समावेश होतो. यांनाच नाद / घोषवर्ण म्हणतात.

क) अनुनासिके :- 'ङ्, ञ्, ण, न्, म्' या वर्णाचा उच्चार जिभेचा तोंडातील इतर भागाना स्पर्श होण्याव्यतिरिक्त नाकातूनही होतो; म्हणून त्यांना अनुनासिक असे म्हणतात.

ii) अर्धस्वर .

'य, र, ल, व' यांची उच्चार स्थाने अनुक्रमे 'इ, ऋ, ऌ, उ' या स्वरांच्या उच्चार स्थानांवरच असल्याने या व्यंजनांचा वरील स्वरांशी निकटचा संबंध आहे; म्हणून त्यांना अर्धस्वर म्हणतात.

अर्धस्वर स्पर्श व्यंजने व उष्मे यांच्या मध्ये येतात; म्हणून त्यांना अंत:स्थ म्हणतात. र्, ल् यांना द्रववर्ण असे सुद्धा म्हणतात.

iii) उष्मे:-

'श, ष, स' यांना उष्मे म्हणतात. वरील वर्णाचा उच्चार करताना घर्षणामुळे उष्णता निर्माण होते. त्यामुळे त्यांना उष्मे (घर्षक) असे म्हणतात.

या वर्णाना सीत्कार असे सुद्धा म्हणतात.

iv)महाप्राण:

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मुलभूत हक्क

कोणत्याही राज्याचा दर्जा ते राज्य तेथील नागरिकांना किती अधिकार देते यावरून ठरतो. पं. नहरूंच्या मते भारतातील सर्व वर्गातील लोकांच्या धार्मिक आणि सांस्कृतिक अधिकारांची सुरक्षितता निर्माण करण्याचे सर्वोत्तम साधन म्हणजे मूलभूत अधिकार होत.

मुलभूत हक्कांचे वर्गीकरण

अ. समतेचा अधिकार (कलम 14 ते 18)

- कायद्यापुढे समानता (14)
- अपवाद राष्ट्रपती व राज्यपाल यांच्यावर कार्यकालात फौजदारी किंवा दिवाणी न्यायालयात चौकशी नाही.
- भेदभावास प्रतिबंध (15)
- स्त्रिया व मुले यांसाठी खास तरतुदी
- मागासवर्गीय यांसाठी खास तरतुदी
- सार्वजनिक नोकऱ्यात समान संधी (16)
- अपवाद मागासवर्गीयांना आरक्षण
- अधिवास ही अट
- अस्पृश्यता निवारणा (17) (पाळणे गुन्हा)
- अपवाद संसर्गजन रोगी
- पदव्यांची समाप्ती (18) देण्यास बंदी
- अपवाद भारतरत्न व पद्म पुरस्कार

ब. स्वातंत्र्याचा अधिकार (कलम 19-22)

कलम 19 नुसार खालील 6 स्वातंत्र्ये

अधिकार	बंधने
1. भाषण अणि विचारस्वातंत्र्य	देशाच्या सार्वभौमत्व व अखंडत्व यांस धोका निर्माण झाल्यास
2. शांततापूर्वक सभा घेण्याचे स्वातंत्र्य	सभ्यता व नैतिकता
3. संस्था व संघ स्थापना करण्याचे स्वातंत्र्य	गुन्ह्यास प्रवृत्त करणे
4. भारतीय प्रदेशात सर्वत्र संचार करण्याचे स्वातंत्र्य	सार्वजनिक सुव्यवस्था बदनामी, न्यायालयाचा अवमान
5. स्थायिक होण्याचे स्वातंत्र्य	सामान जनतेचे हित अ.जमातीचे रक्षण
6. कोणताही व्यापार, व्यावसाय करण्याचे स्वातंत्र्य	सामान्यजनतेचे हित एखाद्या पदासाठी पात्रतेची कौशल्याची अट.

विशिष्ट परिस्थितीत संरक्षणे (20)

पूर्वी केलेल्या कायद्यानेच शिक्षा (गुन्ह्यानंतर नवा कायदा करून शिक्षा नाही.)

एकाचा गुन्ह्यासाठी एकापेक्षा अधिक वेळ शिक्षा नाही.

स्वत:विरूध्द साक्ष देण्याची सक्ती नाही.

व्यक्तीचे जिवित व व्यक्तीस्वातंत्र्य यांची हमी (21)

व्यक्तीच्या जीवीत स्वातंत्र्याचे संरक्षण कायद्याने ठरवलेल्या पध्दतीखेरीज जीवीत व व्यक्तीस्वातंत्र्य हिरावून घेतले जाणार नाही.

सर्वोच्च न्यायालयाने या हक्कात खालील बाबींचा समावेश केला

- प्रतिष्ठापूर्वक जीवन जगणे.
- शुध्द पाणी , हवा, पर्यावरणाचा हक्क
- निवाऱ्याचा हक्क
- गुप्ततेचा हक्क
- आरोग्याचा हक्क

- 14 वर्षे वायार्पयंत मोफत शिक्षणाचा हक्क
- अमानवी वर्तुणुकीच्या विरूध्द हक्क
- न्याय खटल्यांचा हक्क

मनमानी अटकेविरूध्द संरक्षण (22)

24 तासाच्या आत दंडधिकाऱ्यासमोर पसंतीच्या वकीलाचा सल्ला घेण्याचा हक्क

अपवाद परकीय - शत्रू प्रतिबंधात्मक स्थानबध्दतेचा कायदा उदा. रायुका, टाडा, पोटा

क. शोषणाविरूध्दचा हक्क (कलम 23-24)

कलम 23 मानवाचे क्रयविक्रय, वेठबिगारी, गुलामगिरी यांपासून संरक्षण, शरिर विक्रयास बंदी

कलम 24:14 वर्षाच्या आतील मुलामूलींना खाणी वा तत्सम धोक्याच्या ठिकाणी काम करण्यास बंदी.

ड . धार्मिक स्वातंत्र्याचा हक्क (कलम 25-28)

कलम 25 - सार्वजनिक हितास बाधा येणार नाही अशा दृष्टीने प्रत्येक व्यक्तीस कोणताही धर्म स्वीकारण्याचे व त्याचा प्रचार करण्याचे स्वातंत्र्य.

कलम 26 - धार्मिक संस्थांची चल व अचल संपत्तीची मालकी स्वीकारणचा व तिची व्यवस्था पाहण्याचा अधिकार कायद्याने शासनास.

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कलम 28 - शिक्षण संस्थातून धार्मिक शिक्षण देण्यास बंदी.

इ. सांस्कृतिक व शौक्षणिक हक्क (कलम29-30)

कलम 29 - स्वत:ची भाषा, लिपी, संस्कृती, संवर्धनाचा हक्क (20)

कलम 30 - धार्मिक व भाषिक अल्पसंख्याकांना शिक्षणसंस्था स्थापन्याचा हक्क (30)

फ. घटनात्मक उपायांचा अधिकार (32)

- घटनेचा प्राण - डॉ. बाबासाहेब आंबेडकर
- वरील मुलभूत अधिकारांच्या संरक्षणसाठीच
- या अंतर्गत मुलभूत हक्कांवर अतिक्रमण झाल्यास सर्वोच्च न्यायालयात दाद मागता येते.
- सर्वोच्च न्यायालयाचा निर्णय सर्व संस्था, व्यक्ती, शासन यावर बंधनकारक.
- बंदी प्रत्यक्षीकरण अटकेची घटनात्मकता तपासणे.
- परमादेश शासकीय अधिकाऱ्यास काम करण्याचा आदेश.
- प्रतिरोध कनिष्ठ न्यायालयातून वरच्या न्यायालयात वर्ग.
- उत्प्रेक्षण कनिष्ठ न्यायालयाचा निर्णय रद्द करून स्वत:ला वरच्या न्यायालयात वर्ग
- अधिकारपृच्छा

मुलभूत हक्क व सर्वोच्च न्यायालय

कलम 13 मुलभूत हक्क काढून घेणारा कायदा सर्वोच्च न्यायालयात रद्द करू शकते.

कलम 32 मुलभूत हक्कांच्या संरक्षणासाठी कोणीही दाद मागू शकतो.

व्यक्तीच्या हक्कांच्या रक्षणासाठी न्यायालयाला हक्क काढून घेता येत नाहीत.

मार्गदर्शक तत्वे (कलम 36 ते 51)

आयर्लंडच्या घटनेतून

सामाजिक - आर्थिक लोकशाहीचे उद्दीष्ट गाठण्यासाठी घटनेत समाविष्ठ मार्गदर्शक तत्वे म्हणजे सरनाम्यात नमूद केलेल्या तत्वांचा विस्तार

न्यायप्रविष्ठ नसली तरी त्यातील सिध्दांत देशाच्या राज्यकारभाराच्या दृष्ठीने मुलभूत.

मार्गदर्शक तत्वांचे वर्गीकरण

(असे वर्गीकरण घटनेत नाही. केवळ लिहण्याच्या सोयीसाठी वर्गीकरण)

समाजवादी, गांधीवादी, उदारमतवादी

मूलभूत कर्तव्ये

व्यक्तीला जसे हक्क असतात. तशीच कर्तव्येही पार पाडावी लागतात. हक्क व कर्तव्य सारखीच महत्त्वाची आहेत. लोकशाही व्यवस्थेत नागरिकांमध्ये कर्तव्याची भावना