JECRC Foundation

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

Year & Sem – B.Tech I year I Sem
Subject –Engg.Chemistry
Unit – III
Presented by – Ms.Rekha Vijay
Designation - Asst.Professor
Department - Chemistry

VISION OF INSTITUTE

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

MISSION OF INSTITUTE

❖**Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.**

❖**Identify, based on informed perception of Indian, regional and global needs, the areas of focus and provide platform to gain knowledge and solutions.**

❖**Offer opportunities for interaction between academia and industry.**

❖**Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders may emerge in a range of profession.**

Engineering Chemistry: Course Outcomes

Students will be able to:

CO1: Explain the impurities of water (mainly hardness) and boiler troubles.

CO2: Describe processing technologies of fuel with numerical aspects of combustion of fuel.

CO3: Describe the engineering material (cement, glass and lubricant) with respect to their manufacturing, composition, classification & properties.

CO4: Explain corrosion with its controlling measures, organic reaction mechanism and synthesis of drugs (Aspirin & Paracetamol) with their properties and uses.

JECRC
Department of Applied Sciences
Lecture Plan (Session- 2020-2021)

Course Name: Engineering Chemistry **Year/Semester: 1st Year/ Semester- I**

Course code: 1FY2-03 **No. of Lecture Req. /(Avl.): /(40/44)**

Semester starting: 21 Sept. 2020 **Semester Ending: 24 Dec. 2020**

Unit No./ Total Lect. Req.	Topics	Lect. No.	Date of Delivery	Book Referred	Pg. No.
Unit-I 10	Introduction to syllabus, Common natural impurities, hardness, Degree of hardness,	1			
	Units of hardness, Determination of hardness by complexometric (EDTA method).	2			
	Municipal water supply, Requisite of drinking water, purification of water, Sedimentation,	3			
	Filtration, disinfection, Breakpoint chlorination.	4			
	Boiler troubles: Scale and Sludge formation, Internal treatment Methods	5			
	Priming and Foaming, Boiler corrosion and caustic embrittlement	6			
	Water softening: Lime-Soda process	7			
	Water softening: Zeolite (Permutit) process, Demineralization process.	8			
	Numerical problems based on Hardness, EDTA,	9			
	Numerical problems based on Lime-Soda and Zeolite process.	10			

Unit-II 10	**2.Organic Fuels: Solids fuels: Coal, Classification of Coal, Proximate analyses of coal and its significance**	**11**			
	Ultimate analyses of coal and its significance,	12			
	Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter.	13			
	Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method.	14			
	Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking	15			
	Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number	16			
	Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas	17			
	Determination of calorific value of gaseous fuels by Junker's calorimeter, Numerical problems based on Junkers calorimeter	18			
	Numerical problems based on determination of calorific value bomb calorimeter, /Dulongs formula, proximate & ultimate Analysis.	19			
	Numerical problems based on combustion of fuel.	20			

Unit-III 3	**3.Corrosion and its control: Definition and significance of corrosion, Mechanism of chemical (dry) corrosion**	**21**			
	Mechanism of electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion.	22			
	Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.	23		O G Palanna	

Unit-IV 10	**4.Engineering Materials: Portland Cement; Definition, Manufacturing by Rotary kiln.**	**24**			
	Chemistry of setting and hardening of cement. Role of Gypsum.	25			
	Glass: Definition, Manufacturing by tank furnace, significance of Annealing	26			
	Types and properties of soft glass, hard glass	27			
	Borosilicate glass, glass wool, safety glass.	28			
	Lubricants: Classification	29			
	Lubricants: Mechanism	30			
	Properties; Viscosity and viscosity index	31			
	Flash and fire point, cloud and pour point.	32			
	Emulsification and steam emulsion number.	33			

Unit-V 7	**5. Organic reaction mechanism and introduction of drugs: Organic reaction mechanism: Substitution; SN1, SN2.**	**34**			
	Electrophilic aromatic substitution in benzene, free radical halogenations of alkanes,	35			
	Elimination: elimination in alkyl halides, dehydration of alcohols,	36			
	Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones	37			
	Rearrangement: Carbocation and free radical rearrangements	38			
	Drugs : Introduction, Synthesis, properties and uses of Aspirin	39			
	Drugs : Introduction, Synthesis, properties and uses of Paracetamol, Revision	40			

Lecture-23 (Unit-III)

Protection Against Corrosion

It is impossible to control corrosion completely however the rate of corrosion can be minimized by studying the factors that initiate corrosion and taking preventive measures accordingly. These method are focused with a view to eliminate the any of the four essential features of corrosion. These preventive measures can be broadly classified into three categories:

- 1. **Conditioning the metal.**
- **2. Protection by metallic coating**
- **3. Electrochemical control.**

Conditioning the metal.

(1) Suitable Designing

The design of the material should be such that corrosion, if occurs, is uniform and not localized. Following principles may be used:

(i) The contact of dissimilar metals in presence of corroding solution is to be avoided (to avoid formation of galvanic cell).

(ii) The anodic material should have as large area as possible where two dissimilar metals are in contact.

(iii) When two dissimilar metals in contact have to be used, they should be as close as possible in galvanic series.

(iv) The anodic metal should not be painted or coated because any break in coating would cause rapid localized corrosion.

(v) Sharp corners and crevices are the poor design and should be avoided because they favour accumulation of impurities and are the sites of localized corrosion.

(vi) The equipment should be supported on legs for free circulation of air and proper cleaning

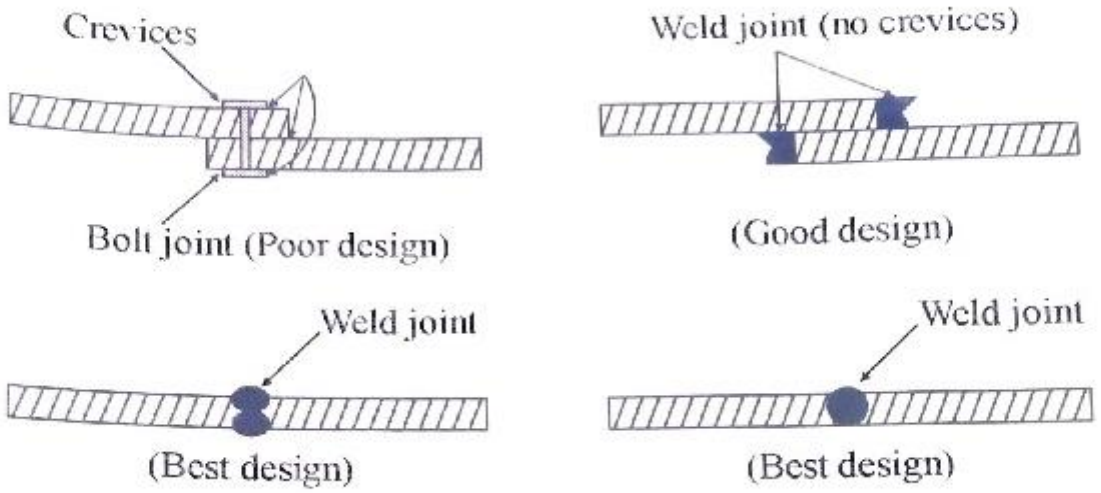
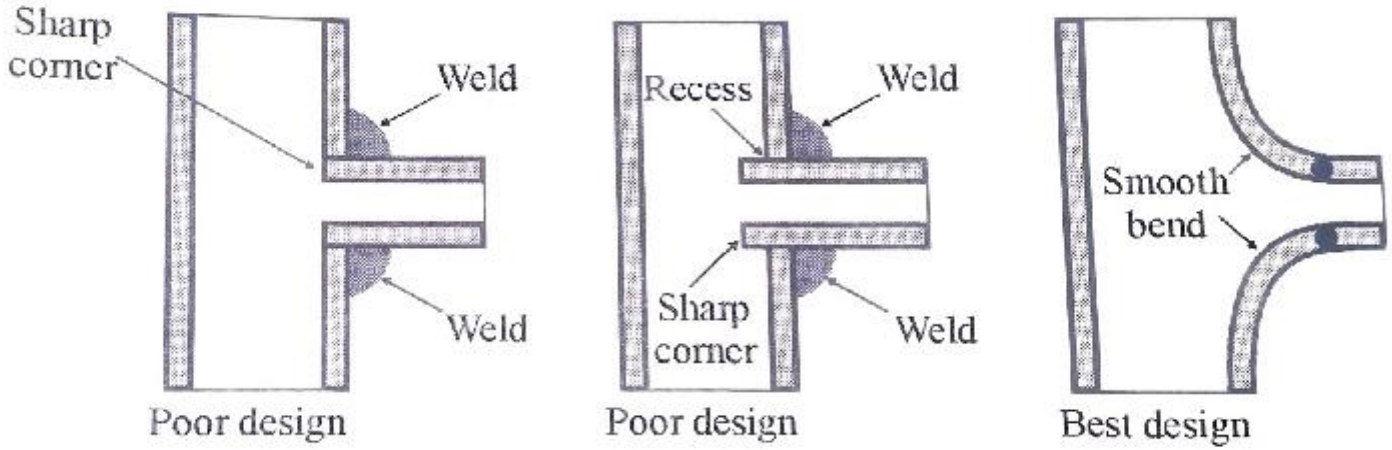


Figure 6.10 Different types of joints



(2) Selection of Material

Using Pure Metal

Since pure metals are resistant to corrosion in comparison to impure one, pure metal must be preferred. However, corrosion resistance of a purified metal depends on the nature of corrosive environment.

Using Metal Alloys

Certain alloys are more resistant to corrosion than pure metals and such alloys must be preferred. Stainless steel containing upto 13% Cr are used in cutlery, surgical instruments, springs etc.

(3) Passivation

The passivation is a method of surface modification. When a piece of iron is dipped in a solution of HNO3, the surface of iron becomes coated with a thin unimolecular layer of oxide which is transparent. The passive surface so produced is resistant to corrosion. The surface can be made again active by change of environment or abrasion of the surface or heating. Recently a number of passivators have been developed

Protection by metallic coating

The metallic surfaces can be protected against corroding atmosphere by coating with non-corroding or least corroding material. Various types of coatings used for this purpose

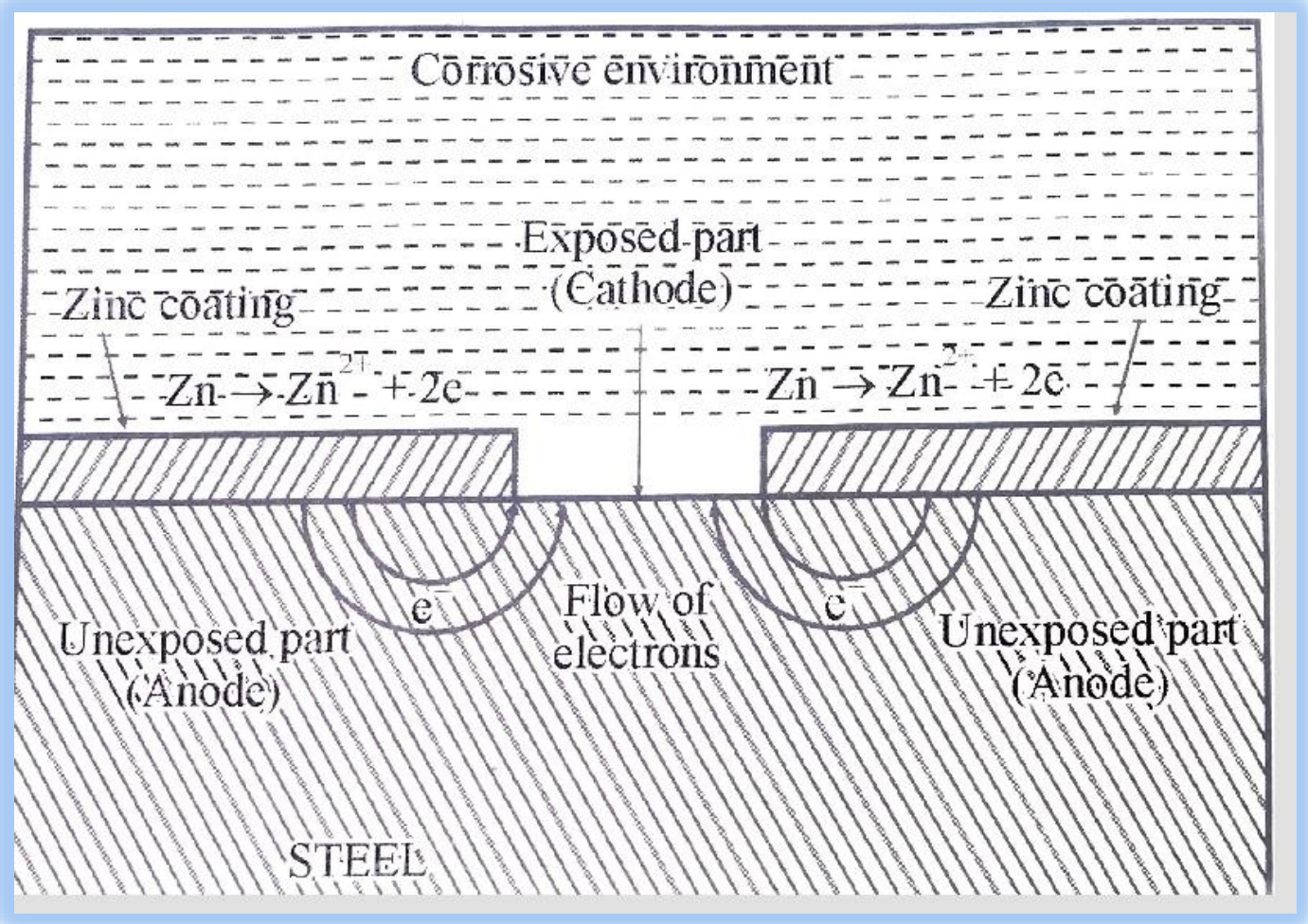
Protective Metallic Coatings

Coating of metal over the other metal/alloy is the most important method of protection from corrosion. The metallic coating can be applied in thin layers by different methods viz. electroplating, hot dipping, spraying with atomized molten metal etc. The selection of coating material depends upon the requirement and nature of the metal to be protected. On the basis of mechanism of corrosion prevention, metallic coatings are of two types:

Anodic coating

These are obtained by coating metals which are "anodic" to the base metal (i.e., the metal to be protected). Anodic coatings protect the base metallic surface by sacrificial manner. For example, coating of Zn (galvanizing), Al and Cd on steel are anodic since these are higher in galvanic series than base metal, iron. If any scratch, pores or discontinuities occur in such an anodic coating, a galvanic cell is formed between the coating metal (anode) and the exposed part of base metal (cathode). It results in corrosion of coating metal and the base metal is protected, e.g. in case of galvanized steel (Zn coated steel), galvanic cell is formed between Zn and exposed iron.

As Zn coating is anodic to iron, it is corroded sacrificially while exposed iron being cathodic is protected. Moreover anode area (coating surface) is large while cathode area (exposed or scratched iron) is small, therefore corrosion occurs at a slow and uniform rate.

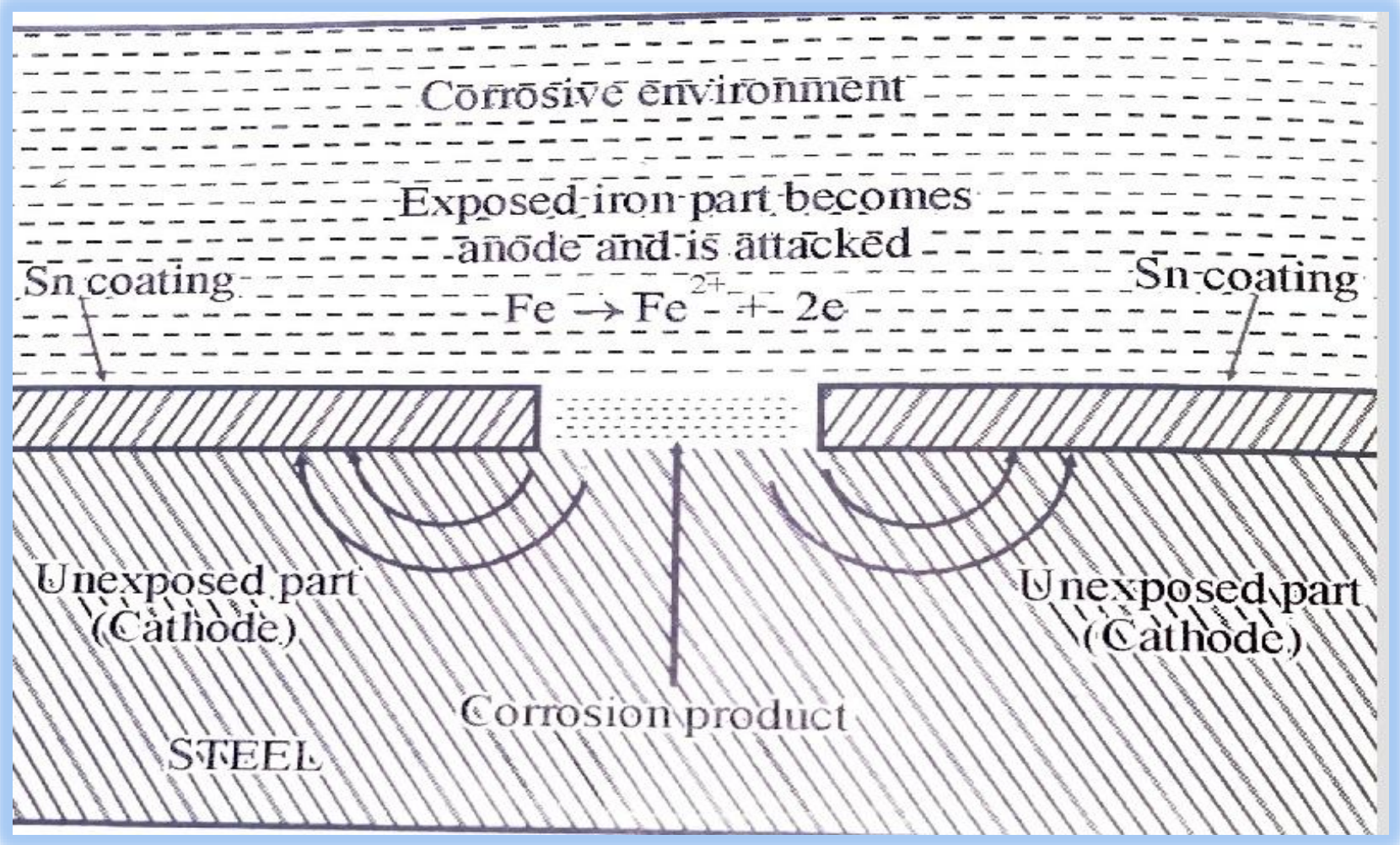


Anodic coating

Cathodic coating

These are obtained by coating a more noble-metal (i.e., lower in galvanic series) than the base metal. They protect the base metal because they have higher corrosion resistance than the base metal. However, these coatings provide effective protection to base metal only when they are completely continuous and free from scratches, breaks or discontinuities.

If such coatings are punctured, much more corrosion damage of base metal can occur than in the case of base metal without coating. For example, a tin-coating (being lower in galvanic series) on a sheet of iron acts as cathodic coating. If the surface coating of tin is punctured, a galvanic cell is set up. In such case, the tin becomes the cathode while the exposed iron surface becomes anode and is corroded. Moreover the anode area (exposed iron surface) is very small compared to large cathode area (tin coating)hence *an intensified, localized corrosion of exposed base-metal (iron) surface occurs.*



Cathodic coating

Electrochemical Control

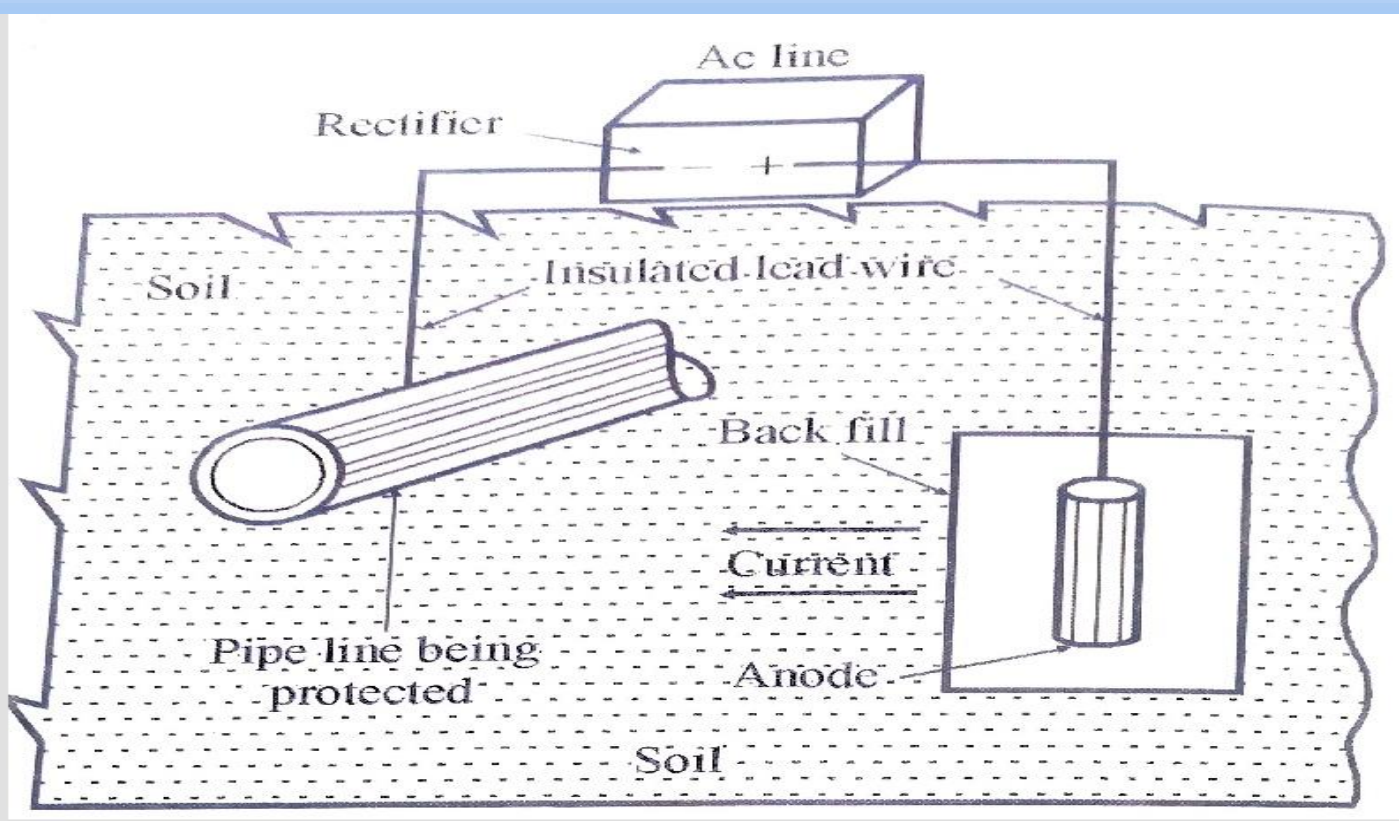
Cathodic Protection-Method :

The principle involved in this method is to force the metal to be protected to behave like a cathode, thereby corrosion does not occur there are two type of cathodic protections:

(1)Impressed Current Cathodic Protection

In this method, an impressed current (through d.c. source) is applied in opposite direction to nullify the corrosion current and convert the earlier corroding metal from anode to cathode. The metal structure to be protected is connected to negative terminal of the power source through insulated lead wire and hence behaves as cathode whereas a group of auxiliary anodes (ground bed) is connected to positive terminal of the source. The auxiliary anodes are generally ceramic coated one or oxide coated titanium. This type of protection technique is, particularly, useful for large structures intended for long-tern operations.

The ships are protected against corrosion by connecting the surface to negative terminal of a DC generator. This method is applicable even in high resistivity environment.

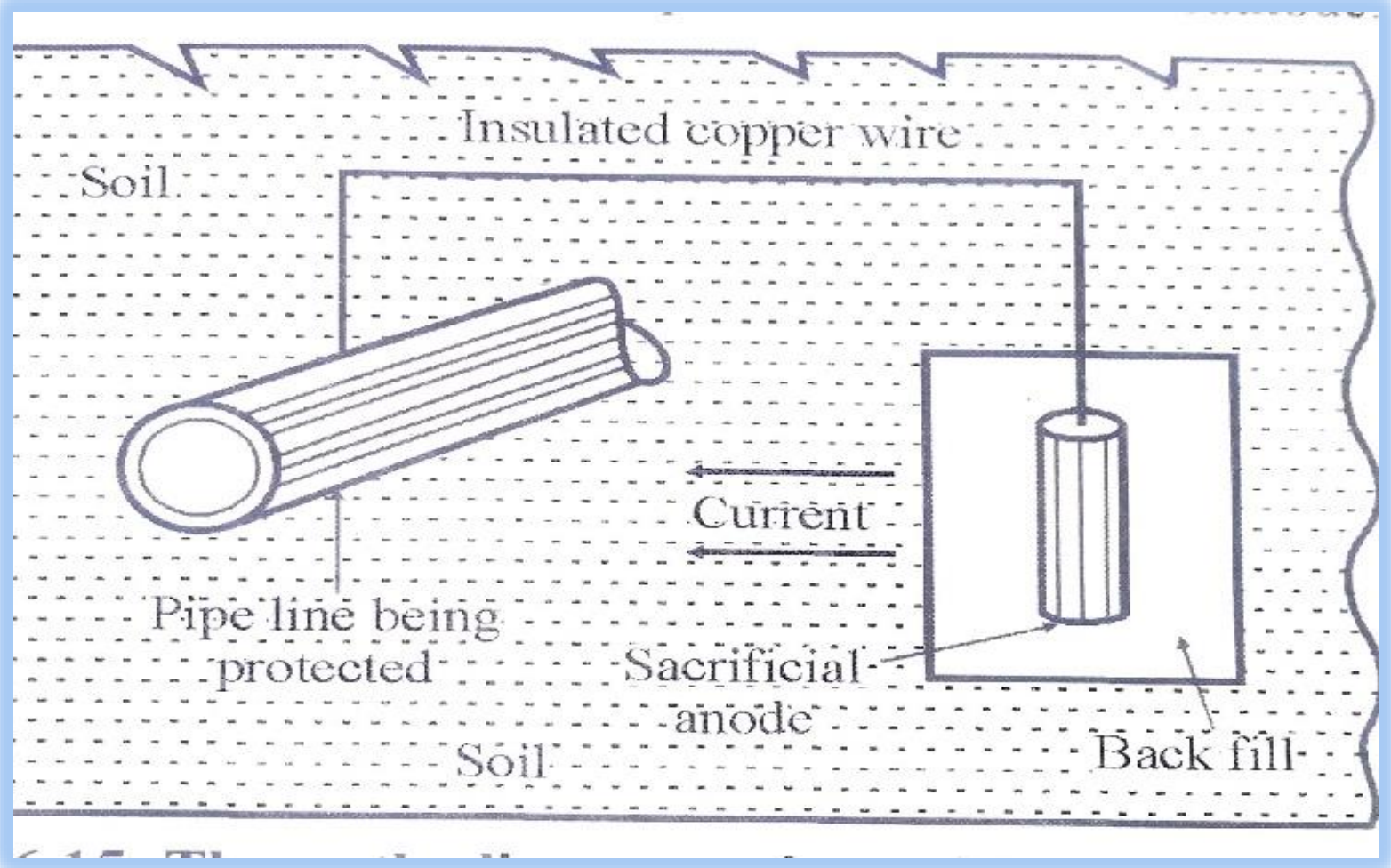


Impressed Current Cathodic Protection

Sacrificial Anodic Protection Method

In this method, the metal to be protected is connected to the more active metal (like Zn Mg). Under these conditions, the more active metal becomes anode and undergoe corrosion sacrificially' while metal to be protected becomes cathode.

The cathodic protection with sacrificial anode The railway track and petroleum carrying pipe network is protected by the method. This method requires less maintenance but is ineffective in high resistivity environment.



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Suggested links from NPTEL

https://onlinecourses.nptel.ac.in/noc20_mm24/preview

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Thank you!