2 MARKS QUESTION & ANSWERS

DEPARTMENT OF CIVIL ENGINEERING

CE6021 - REPAIR AND REHABILITATION OF STRUCTURES

UNIT I - MAINTENANCE AND REPAIR STRATEGIES

PART – A (2 Marks)

1. **Define – Maintenance** (A–11)
   Maintenance is the act of keeping something in good condition by checking or repairing it regularly.

2. **Define – Repair** (A–12)
   Repair is the process of restoring something that is damaged or deteriorated or broken, to good condition.

3. **Define – Rehabilitation** (M–12)
   Rehabilitation is the process of returning a building or an area to its previous good conditions.

4. **What are the two facets of maintenance?**
   The two facets of maintenance are
   - Prevention
   - Repair

5. **What are the causes of deterioration?** (N–12)
   - Deterioration due to corrosion
   - Environmental effects
   - Poor quality material used
   - Quality of supervision
   - Design and construction flaws

6. **Discuss the physical inspection of damaged structure.**
   Some of the use full information may be obtained from the physical inspection of damaged structure, like nature of distress, type of distress, extent damage and its classification etc, their causes preparing and documenting the damages, collecting the samples for laboratory testing and analysis, planning for in situ testing, special environmental effects which have not been considered at the design stage and information on the loads acting on the existing structure at the time of damage may be, obtained. To stop further damages, preventive measure necessary may be planned which may warrent urgent execution.

7. How deterioration occurs due to corrosion?
   - Spalling of concrete cover
   - Cracks parallel to the reinforcement
   - Spalling at edges
   - Swelling of concrete
   - Dislocation
   - Internal cracking and reduction in area of steel reinforcement.

8. What are the steps in selecting a repair procedure?
   - Consider total cost
   - Do repair job in time
   - If defects are few & isolated repair on an individual basis.
   - Otherwise do in generalized manner
   - Ensure the repair prevents further development of defects
   - In case of lost strength, repairs should restore the strength
   - If appearance is a problem, the number of applicable types of repairs become limited & the repairs must be covered
   - Repair works should not interface with facilities of the structure

9. Discuss about the environment effects which leads to deterioration of concrete structure.
   Micro-cracks present in the concrete are the sources of ingress of moistures atmospheric carbon di-oxide into the concrete which attack reinforcement and with various ingredients of concrete. In aggressive environme4nt concrete structure will be severely reduces.

10. What is the effect of selecting poor quality material for construction?
    Quality of materials, to be used in construction, should be ensured by means various tests as specified in the IS codes. Alkali-aggregate reaction and sulphate attack results in early deterioration. Clayey materials in the fine aggregates weaken the mortar aggregate bond and reduce the strength. Salinity causes corrosion of reinforcing bars as well as deterioration of concrete.

11. How can we determine the cause for deterioration of concrete structure? (N–12)
    - Inspect & observe the structure
    - Observe in bad & good weather
    - Compare with other constructions on the area or elsewhere & be patient
    - Study the problem & allow enough time to do the job

12. What are the factors to be considered by the designer at the construction site? (N–13)
    - Minimum and maximum temperatures
    - Temperature cycles
    - Exposure to ultra violet radiation
    - Amount of moisture
    - Wet/dry cycles
    - Presence of aggressive chemicals

13. What are the steps in repair aspect? (M–14)
    - Finding the deterioration
    - Determining the cause
    - Evaluating the strength of existing building or structure
    - Evaluating the need of repair
    - Selecting & implementing a repair procedure

14. What is the fixed percentage method of evaluating the strength of existing structure?
    It is to assume that all members which have lost less than some predetermined % of their strength are still adequate and that all members which have lost more than the strength are inadequate. It is usually from 15% onwards higher values are applicable for piling % stiffness bearing plates etc.

15. Discuss about the design and construction errors leading to deterioration of a structure.
    Design of concrete structures governs the performance of concrete structures. Well designed and detailed concrete structure will show less deterioration in comparison with poorly designed and detailed concrete, in the similar condition. The beam-column joints are particularly prone to defective concrete, if detailing and placing of reinforcement is not done properly. Inadequate concrete cover may lead to carbonation depth reaching up to the reinforcement, thus, increasing the risk of corrosion of the reinforcement.

16. Discuss about the quality of supervision to be followed at a site.
    Construction work should be carried out as per the laid down specification. Adherence to specified water-cement ratio controls strength, permeability durability of concrete. Insufficient vibration may result in porous and honey combined concrete, whereas excess vibration may cause segregation.

17. What are the possible decisions that can be made after evaluating the strength of a structure?
    - to permit deterioration to continue
    - to make measures to preserve the structure in its present condition without strengthening
    - to strengthen the construction
    - if deterioration is exceptionally sever, to reconstruct or possibly abandon it.

18. How can we evaluate the strength of existing structure by stress analysis?
    This method is to make detailed stress analysis of the structure, as it stands including allowances for loss of section where it has occurred. This is more difficult & expensive. Here also the first stop is to make preliminary analysis by fixed percentage method and if it appears that major repairs will be required, the strength is reevaluated based on detailed stress analysis, considering all contributions to such strength.

19. Discuss the load test method of evaluating the strength of existing structure.
    Load tests may be required by the local building offered, but they should only be performed where computation indicated that there is reasonable margin of safety against collapse, lest the test bring the structure sown. Load test show strengths much greater than computed strengths when performed on actual structures. When performed on actual structures. In repair work every little bit of strength is important.

20. What are the possible decisions after finding a structure to be inadequate?
- if the appearance of the existing condition is objectionable – repair now
- if appearance is not a problem then
- Put the condition under observation to check if it is dormant or progressive.
- if dormant – no repair
- if progressive – check the feasibility & relative economics of permitting deterioration to continue and performing a repair at some later date & of making the repair right away

21. Write short notes on weekly and monthly maintenance? (A–13)

Maintenance can also be classified based on duration or frequency.

Weekly routine maintenance:
- Electrical accessories
- Cob webs cleaning
- Flushing sewer line
- Leakage of water line

Monthly routine maintenance:
- Cleaning door, window latches, etc;
- Checking septic tank/sewer
- Observation for cracks in the cement

22. Discuss about repairing of concrete floor?
- Prior to remove of masonry or concrete floor adequate support, centering should be provided
- Planks of sufficient strength should be provided to give workmen firm support to guard against any unexpected floor collapse

23. What is preventive maintenance? (N–12)
- Preventive maintenance is intended to preserve the structure by preventing the failure and detecting the incipient fault, before failure takes place
- It includes thorough inspection ,planning the program of maintenance and executing the work

24. Define – Defect (A–13,15)
- The structural defects like settlement of foundation , masonry walls, beam, cracks in the masonry walls, slab beam and other element of the building
- Deflection and sagging of member like beam ,slab purlin,rafter, lintel must also observed and needs any procedure for improving the same should be decided looking after their causes

25. What is economic appraisal of structure? (A–14)

There is a wrong notion in the mind of people that regular maintenance makes the building usage costly and uneconomical. If the real cost of building for the serviceable life is considered then the regularly maintained buildings are much economical and cost effective due to enhanced serviceable life.

PART – B (16 Marks)

1. Explain in detail, the importance of maintenance. (A– 09,13,15,D – 09)
2. Explain in detail, the facets of maintenances? (A– 15, N– 09,11,12)
3. Explain in detail, the assessment procedure for evaluating damages in structures with flow chart diagram? (M– 13,14, N– 13)
4. What is maintenance? Explain in detail, the facets and importance of maintenance with various inspection procedures? (N–13)
5. Explain in detail, the service life behavior of a concrete structure with a graph, and about time based maintenance? (M–12,13)
6. Explain in detail, the various causes for deterioration of concrete? (A –11, N –11)
7. Explain in detail, about the prevention aspect of maintenance?
8. Explain in detail, about the repair aspect of maintenance? (N–13)
9. Explain in detail, about the permeability of concrete?
10. Explain in detail, about the inspection to be carried out during and after the construction of structure

UNIT - II : STRENGTH AND DURABILITY OF CONCRETE

PART – A (2 Marks)

1. How can use prevent the effect of freezing and thawing in concrete?

Concrete can be restricted from frost action, damage of the structure by the entrainment of air. This entrainment of air is distributed through the cement paste with spacing between bubbles of no more than about 0.4mm.

2. Write any two tests for assessment of frost damage?

The frost damage can be assessed by several ways:

- Assessment of loss of weight of a sample of concrete subjected to a certain number of cycles of freezing and thawing is one of the methods
- Measuring the change in the ultrasonic pulse velocity or the damage in the change in the dynamic modulus of elasticity of specimen is another method.

3. How does a concrete structure get affected by heat?

Heat may affect cone and as a result of:-

- the removal of evaporable water
- the removal of combined water
- alteration of cement past
- alteration of aggregate
- change of the bond between aggregate and paste
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4. How can you control cracks in a structure?

- Use of good coarse aggregates free from clay lumps
- Use of fine aggregate free from silt, mud & organic constituent.
- Use of sound cement.
- Provision of expansion & contraction joint.
- Provide less water-cement ratio

5. Define – Aggregate Splitting

This phenomenon occurs most frequently when hard aggregates are used in concrete. The thermal stresses except close to corners are predominantly compressive near to the heated surface. This stress causes the aggregate to split in this direction and the fractures may propagate through the mortar matrix leading to deterioration.

6. What the factor affecting chemical attack on concrete?

- High porosity
- Improper choice of cement type for the conditions of exposure
- Inadequate curing prior to exposure
- Exposure to alternate cycles of wetting and drying

7. Write the methods of corrosion protection?
   - Corrosion inhibitors
   - Corrosion resisting steels
   - Coatings for steel
   - Cathodic protection

8. List out some coating for reinforcement to prevent corrosion?
   - Organic coating
   - Epoxy coating
   - Metallic coating
   - Zinc coating

9. Define – Corner Reparation

   This is a very common occurrence and appears to be due to a component of tensile stress causing splitting across a corner. In fire tests, corner separation occurs most often in beams and columns made of Quartz aggregate and only infrequently with light weight aggregates

10. List any four causes of cracks? (A–14)
    - Use of unsound material
    - Poor & bad workmanship
    - Use of high water-cement ratio
    - Freezing & thawing
    - Thermal effects
    - Shrinkage stresses

11. What are the types of cracks?
    - Class-1: Cracks leading to structural failure
    - Class-2: Cracks causing corrosion
    - Class-3: Cracks affecting function
    - Class-4: Cracks affecting appearance

12. What changes occur, when hot rolled steel is heated to 500^0 C?

    At temp of 500^0 C – 600 ^{0}C the yield stress is reduced to the order of the working stress and the elastic modulus is reduced by one-third. Bars heated to this temp virtually recover their normal temperature.

13. List out the various types of spalling?

    i) General or destructive spalling

    ii) Local spalling which is subdivided as
    - aggregate splitting
    - comer separations
    - surface spalling
    - Sloughing off

14. List some faults in construction planning?
    - Overloading of members by construction load
    - Loading of partially constructed members
    - Differential shrinkage between sections of construction
    - Omission of designed movement joints

15. Define – Corrosion (A –11)
    The gradual deterioration of concrete by chemically aggressive agent is called "corrosion"

16. Give some types for corrosion inhibitors? (M– 09)
    - Anodic inhibitors
    - Cathodic inhibitors
    - Mixed inhibitors
    - Dangerous & safe inhibitors

17. Define - Effective Cover (M–09, A–14)
    The cover to reinforcement measured from centre of the main reinforcement up to the surface of concrete in tension is called "Effective cover"

18. Define – Corrosion Inhibitor (M– 09)
    Corrosion inhibitor is an admixture that is used in concrete to prevent the metal embedded in concrete from corroding.

19. What are the operations in quality assurance system?
    - Feed back
    - Auditing
    - Review line
    - Organization

20. List the various components of quality control.
    Five components of a quality (control) assurance system are:
    - Standards
    - Production control
    - Compliance control
    - Task and responsibilities and
    - Guarantees for users

21. List the importance of quality control? (A–10)
    - Quality control is mainly to check the quality necessary to give good performance and good appearance throughout its intended life
    - Quality of material, equipment and workmanship should be checked now and then tomake the quality control a successive one.

22. Classify cracks based on its thickness? (M–12)

Based on the thickness, crack are classified as

- Fine crack (width < 0.1 mm)
- Thin crack (0.1 mm – 0.3 mm)
- Medium crack (0.3 mm – 0.7 mm)
- Wide crack (0.7 mm – 2 mm)
- Very wide crack (width > 2 mm)

23. List any four durability parameter? (J–13)

The following are some of the durability parameter:

- Water – cement ratio
- Curing period
- Cover to reinforcement
- Aggregate

24. Discuss the mechanism of cathodic protection? (M–13)

- Cathodic protection is a technique by which the electricity potential of the steel is increased to a level at which corrosion cannot take place
- It is done by two different methods (i) Impressed current (ii) sacrificial anodes
- Impressed current method, the structure is connected to the negative terminal of a DC power supply
- Sacrificial anode method, the reinforcement is connected to anode with higher negative

25. Discuss the importance of coefficient of thermal expansion with respect to strength of concrete? (J–12)

Thermal resistance of concrete decides the life time of concrete. it play a vital role in runways, chemical storage tanks, nuclear power plant, high temperature reactors etc and Cement paste, aggregate and reinforcement steel have more or less non- uniform co- efficient of thermal expansion. Here reinforcement steel expands first when subjected to higher temperature ,so reduction in diameter of steel take place

PART - B : (16 Marks)

1. Explain in detail, about the effects of sustained elevated temperature on hardened reinforced concrete?
2. Explain in detail, about the design errors for concrete building? (A–14)
3. Why quality assurance for structure is needed? Explain in detail, the components of quality assurance for building? (A–14)
4. Explain in detail, about any four methods of corrosion protection techniques which are to be followed in concrete structures? (M–14)
5. Explain in detail, about serviceability and durability of concrete structures under the heading of quality assurance in concrete? (N –13)
6. Explain in detail, about the design and construction error in RC structures with remedial measures?
7. Explain in detail, about the thermal properties of concrete? (M –13)
8. Explain in detail, about the mechanism of corrosion with chemical equation? (M–12)
9. Explain in detail, about the possible design and constructional errors in construction? (M –12)
10. Explain in detail, about the quality assurance play an important role in construction industry and the parameter affecting the quality concrete construction? (N–12)

UNIT - III : SPECIAL CONCRETES

PART – A (2 Marks)

1. What is expansive cement? (N– 09)

A slight change in volume on drying is known as expansion with time will prove to be advantage for grouting purpose. This type of cement which suffers no overall change in volume on drying is known as "Expansive cement".

2. What is the action of shrink comb in expansive cement?

Shrink comb grout acts like a Portland cement. It (shrinks) sets and hardens; it develops a compressive strength of about 140 kg/gm^2 at 7days and 210 kg/cm^2 at 28 days.

3. List the various types of polymer concrete?

- Polymer impregnated concrete (PIC)
- Polymer cement concrete (PCC)
- Polymer Concrete (PC)
- Partially impregnated and surface coat polymer Concrete.

4. Give the various monomers used in polymer concrete.

- Methylmethacrylate (MMA)
- Styrene
- Acrylonitrile
- t-butyle styrene

5. Define – Polymer Concrete

Polymer concrete is a aggregate bound a polymer binder instead of Portland cement as in conventional concrete pc is normally use to minimize voids volume in aggregate mass.

This can be achieve by properly grading and mixing to attain the max density and (mixing) the aggregates to attain (maximum) minimum void volume. The entrapped aggregated are prepacked and vibrated in a mould.

6. What are the uses of Polymer concrete?

- During curing Portland cement form mineral voids. Water can be entrapped in these voids which are freezing can readily attack the concrete.
- Also alkaline Portland cement is easily attached by chemically aggressive materials which results in rapid determination, there as using polymers can compact chemical attack.

7. What is sulphur infiltrated concrete?

New types of composition have been produced by the recently developed techniques of impregnating porous material like concrete with sulphur. Sulphur impregnation has shown great improvement in strength.

8. What are the applications of sulphur infiltrated concrete?
   - Sulphur – (impregnated) infiltration can be employed in the precast industries.
   - Sulphur infiltration concrete should found considerable use in industry situation where high corrosion resistant concrete is required.
   - This method cannot be conveniently applied to cast- in place concrete Sulphur impregnation has shown area improvement in strength.

9. What is drying shrinkage?
   Concrete made with ordinary Portland cement shirts while setting due to less of water concrete also shrinks continuously for long true. This is known as “drying shrinkage”.

10. What is self stressing cement?
    This cement when used in concrete with restrained expansion includes compressive stresses which approximately offset the tensile stresses induced by shrinkage “self Stressing cement”

11. What is polymer impregnated concrete?
    PIC is a widely used polymer composition concrete, cured and dried in over or dielectric heating from which the air in the (pipes) open cell is removed by vacuum.
    Then low density manpower is diffused through a open cell and polymerized by using radiation, application of heat or by chemical initiation.

12. Define – Polymer Partially Impregnated Concrete (PPIC)
    - Polymer partially impregnated and surface coated (SC) control partially polymer impregnated concrete is used to in the strength of concrete.
    - Partially impregnated concrete is sufficient in situations there the major required surface persistent against chemical and mechanical attacks.

13. How can we manufacture sulphur infiltrated concrete?
    Sulphur is heated to bring it into molten condition to which coarse and fine aggregates are poured and mixed together. On cooling, this mixture gave fairly good strength, exhibited acid resistance and also other chemical resistance, but it proved to be either than ordinary cement concrete.

14. What is the difference between ordinary cement and expansive cement?
    Ordinary concrete shrinks while setting whereas expansive cement expands while setting

15. What are the uses of gas forming and expansive chemicals
    - Gas formation and expansive chemicals are to produce light weight concrete as well as to cause expansion on application such as grouts for anchor bolts.
    - They are non strinking type. Principal chemicals used are Hydrogen peroxide, metallic aluminium or activated or activated carbon. Sometimes bentonite clays and natural gum are also used.

16. What is the use of corrosion inhibiting chemicals
    - They resist corrosion of reinforcement .in adverse environment
    - Sodium benzonate ,calcium lingo sulphonate and sodium nitrate have good result

17. Write the use of antifungus admixtures
- These are added to control and inhibit growth of bacteria or fungus in surfaces exposed to moisture.
- Polyhalogenated phenol, Dieldrin emulsion and copper compounds are some of the chemicals used for this

18. What are use of curing compounds

They are either wax based or resin based. When coated in freshly laid concrete they form a temporary film over the damp surface which stops water evaporation and allows sufficient moisture retention in concrete for curing

19. What are the uses of sealants
- They are used to seal designed joints. They are formulated from synthetic rubbers or polysulphides.
- The choice of a sealant depends on the location of the joint, its movement capability and the function the sealant is expected to perform.

20. what are the uses of flooring
- These are usually toppings based on metallic or non metallic aggregates which are mixed with cement and placed over freshly laid concrete sub floor.
- These compounds in high viscosity liquid, form mixed with recommended filters at site, are based on resins and polymers such as epoxy, acrylic, polyuretheneor polysulphide.

21. What are admixtures? Give examples. (M– 12)

Admixture are materials other than cement, aggregate and water that are added to concrete either before or during its mixture to alter its properties, such as workability, curing temperature range, set time or color.

22. List the uses and properties of Ferro - cement? (A –14)
- Improved cracking resistance
- High tensile strength-to-weight ratio
- Capability of improving some of the mechanical properties of treated structure
- Ability to withstand thermal changes effectively

23. List the type of reinforcement used in ferro cement concrete? (A – 10)
- Wire mesh with closely spaced wires
- Expanded metal mesh
- Welded wire fabrics
- Square steel wire mesh
- Hexagonal or chicken wire mesh

24. Define – Aspect Ratio (M–12)
- The fiber is often described by a conventional parameter called “aspect ratio”. It is given by (L/d). The aspect ratio of the fiber is the ratio of its length to its diameter.
- Aspect ratio is the important factors which influence the properties and behavior of the fiber composite.

25. List the disadvantages of FRP? (A–11)

- Highly expensive
- Brittle characteristic
- Debonding failure
- Rupture failure
- Low ductility

PART - B (16 Marks)

1. Explain in detail, about the manufacturing process and application of sulphur infiltrated concrete?
2. What are the purposes of using concrete chemicals? Explain in detail, how are they grouped /classified based on their use? (N– 11)
3. Explain in detail, about manufacturing process polymer concrete? (M– 09)
4. Explain in detail, about manufacturing process fiber reinforced concrete? (A–11)
5. Explain in detail, about manufacturing process of expansive cement? (M– 09,13)
6. Explain in detail, about polymer modified concrete and its application? (M– 09)
7. Tabulate the different types of fibres used in concrete and list the advantages? (M– 13)
8. Explain in detail, about the behavior of steel fiber reinforced concrete and ferro – cement as a repair material. (M– 14,13)
9. Explain in detail, about aspect ratio and volume fraction with respect to fiber reinforced concrete. Also explain the effects on fresh and hardened concrete with stress strain curve? (N–12)
10. Explain in detail, the enhanced properties of FRC compared to conventional concrete? (M– 09)

UNIT - IV : TECHNIQUES FOR REPAIR AND PROTECTION METHODS

PART – A (2 Marks)

1. What is Vacuum concrete method? (N–12)

Only about half of the water added in concrete goes into chemical combination and the remaining water is used to make concrete workable. After laying concrete, water which was making concreting workable is extracted by a special method known as “vacuum concrete method”.

2. What are the equipments used in vacuum concrete method?

The equipment essentially consists of:-

- Vacuum pump
- Water separator and
- Filtering mat

3. What is Gunite? (M–14)

Gunite can be defined as mortar conveyed through a hose and pneumatically projected at a high velocity on to a surface.

4. What are the two types of process in Shotcrete?

- Wet mix process
- Dry mix process

5. What are the stages in dry mix process in shotcrete?

- In this process, the concrete is mixed with water as for ordinary concrete before conveying through the delivery pipeline to the nozzle, at which point it is jetted by compressed air, onto the work in the same way as that if mix process.
- The wet process has been generally desired in favour of the dry mix process,owing to the greater success of the latter.

6. What is shotcrete? (M–14)

Shotcrete is a recent development on the similar principle of guniting for achieving greater thickness with small coarse aggregate.

7. What are the preliminary investigations before demolition of a structure?

The demolition contractor should have ample experience of the type of work to be offered;

- Fully comprehensive insurance against all risks must be maintained at all times;
- An experienced supervisor should be continuously in charge of the work;
- The contract price should include all safety precautions included in the relevant
- building regulations;
- The completion date should be realistic, avoiding and need to take risks to achieve the date.

8. Write about protective clothing given before demolition.

Buildings where chemicals have been stored or where asbestos, lead paint, dust or fumes may be present will require specialized protective clothing, to prevent the spreading .

9. Differentiate between shoring and underpinning? (M– 09, A– 10,11,14)

Si.no	Underpinning	Shoring
1	Underpinning is employed to replace or strength the foundation of an existing strructure	Shoring is employed to prevent a damaged structure due to foundation settlement or other reason from collapse
2	Remedial underpinning is done to provided additional foundation strength to an inadequately supported structure	It is also used to provided temporary support to a structure which is being remodeled or altered
3	Methods: • Pit method • Pile method	Types: • Raking shores • Horizontal shores and Vertical shores

10. What are the major factors in selecting a demolition procedure?

Majors factors to be considered in selecting an appropriate technique include:-

- Safety of personnel and public
- Working methods
- Legislation applicable
- Insurance cover

11. Give the categories of demolition techniques. (N– 11)

Demolition techniques may be categorized as:-

- Piecemeal demolition, using hand-held tools or machines, to reduce the height of the building or structure gradually;
- Deliberate controlled collapse, demolition to be completed at ground level.
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12. Write short notes on demolition by hand.

- Demolition of buildings or structure by hand-held tools such as electric or pneumatic breakers, sometimes as a preliminary to using other methods, should be carried out, where practicable, in the reverse order to the original construction sequence.
- Lifting appliances may be necessary to hold larger structural members during cutting and for lowering severed structural members and other debris.

13. In what cases demolition by machine can be done? (A–10)

Simple roof structures supported on wall plates should normally be demolished to the level of wall plates by hand, but if this may involve unsafe working, then demolition totally by machine may be appropriate.

14. Write short notes on balling machine.

Balling machines generally comprise a drag-line type crawler chassis fitted with a lattice crane jib. The demolition ball, with a steel anti-spin device, is suspended from the lifting rope and swung by the drag rope.

15. How are explosives used for demolition of a structure?

If explosives are to be used for demolition, the planning and execution, include pre-weakening, should be under the control of a person competent in these techniques. For large demolition, the competent person is likely to be an experienced explosive engineer; for smaller work, a shot-firer may be sufficient.

16. What is a hydraulic pusher arm?

Articulated, hydraulically-powered pusher-arm machines are normally mounted on a tracked or wheeled chassis, and have a toothed plate or hook for applying for applying a horizontal force to a wall. The machine should stand on a firm level base and apply force by a controlled movement of the pusher arm.

17. What is pre-weakening?

- Buildings and structures normally have structural elements designed to carry safely the loading likely to be imposed during their life.
- As a preliminary to a deliberate controlled collapse, after loads such as furnishings, plant and machinery have been removed, the demolition contractor may be able to weaken some structural elements and remove those new redundant.
- This preweakening is essentially a planned exercise and must be preceded by an analysis of its possible effects on the structure until it collapses, to ensure that the structural integrity of the building is not jeopardized accidentally.
- Insufficient information and planning relating to the structure may result in dangerous and unsafe work.

18. What is deliberate collapse?

- The deliberate collapse of the whole or part of a building or structure requires particularly high standards of planning, supervisions and execution, and careful consideration of its effect on other parts of the structure or on adjacent buildings or structures.
- A surrounding clear area and exclusion zone are required to protect both personnel and property from the fall of the structure itself and debris which may be thrown up by the impact.

19. How can you develop a demolition strategy?

The strategy will need to take into account the method of construction used for the original building and its proximity to other buildings, structures and the general public. These factors, together with location, the cost and availability of tipping and disposal and the desirability and economics of reuse, must be taken into account in the development of an appropriate strategy for the demolition of a structure.

20. What are nibblers?

Nibblers use a rotating action to snap brittle materials such as concrete or masonry. In either case, material should be removed from the top of walls or columns in courses not greater than 600mm in depth, steel reinforcement should be cut separately as necessary.

21. What are the considerations before demolition? (A–14)

Considerations should be given to:-

- Conducting a site and building survey, with a structural bias;
- The examination of drawings and details of existing construction where available;
- The preparation of details and drawings from site survey activities where no such information is available;
- Establishing previous use of premises, especially with regard to flammable substances or substances hazardous to health or safety;

22. What is a dry pack? (N–12, M–12,13)

- Dry pack is low water cement ratio mortar or stiff sand –cement mortar that is typically used to repair small area that are deeper than they are wide
- It is used to make repair to a floor or wall of concrete to fill holes and cracks
- It is also used to repair concrete driveways, basement floorand grages

23. What are the characteristics of good coating? (A–10)

- Low viscous
- High durable
- Excellent bonding property
- Good flexibility
- Resistant to UV rays
- Resistant to chemicals and environmental

24. How the jacketing done? (A–14)

- Jacketing is a techniques of restoring or increasing the section of an existing member by enchasing it in a new concrete
- This method is useful for protection of section against further deterioration by providing additional strength to the member.
- Concrete jacketing and ferrocement jacketing is widely used in current practices.

25. Discuss about the leakage in structure (A–11)

- Leakage in concrete structure causes inevitable damage to the reinforcement
- Construction joints ,shrinkage and resistant crack may form leak packs
- Damp- patches may also be formed when water passes through the void along the reinforcing bars formed due to plastic settlement.

PART - B : (16 Marks)

1. Explain in detail, about any two corrosion protection methods? (M – 12,13)
2. Explain in detail, about the manufacturing process, materials used and advantages of foamed concrete? (A– 15)
3. Explain in detail, about vacuum concrete and its application? (A– 14)
4. Explain in detail, about the techniques available to demolish the structures? (N–13)
5. Explain in detail, how cracks may be sealed by using epoxy injection resin? (M–13)
6. Explain in detail, the various strengthening techniques to overcome low member strength?
7. Explain in detail, about types of shotcreting and its application? (N– 11)
8. Write short notes on a) Underpinning b) Rust eliminator (N–12)
9. How do you demolish an overhead water tank situated in a thickly populated area? (A– 09,10)
10. Explain in detail, about the techniques available for the protection of rebar? (N– 11,12)

UNIT - V : REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

PART – A (2 Marks)

1. What are the techniques required for repairing cracks?
   - Bonding with epoxy
   - Routing and sealing
   - Stitching
   - Blanketing
   - External stressing
   - Grouting
   - Autogenous healing

2. Define – Stitching

   The tensile strength of a cracked concrete section can be restored by stitching in a manner similar to sewing cloth.

3. What do you mean by blanketing?
   - This is the simplest and most common technique for sealing cracks and is applicable for sealing both fine pattern cracks and larger isolated.
   - The cracks should be dormant unless they are opened up enough to put in a substantial paten in which case the repair may be more property termed as “Blanketing”.

4. Define – External Stressing

   Development of cracking in concrete is due to tensile stress and can be arrested by removing these stresses. Further the cracks can be closed by including a compressive force sufficient to over come the tension a residual compression.

5. Write short notes on Autogenous healing.
   - Autogenous healing is the nature process of crack repair that can occur in concrete in the presence of moisture, and the absence of tensile stress.
   - The repair is by a combination of mechanical blocking by particles carried into the crack with the water and the deposit of calcium carbonate from the cementitious material.

6. What is overlay? (A–10)
   - Overlays may be used to restore a spelling or disintegrated surface or to protect the existing concrete from the attack of aggressive agents.
   - Overlays used for this purpose include concrete or mortar, bituminous compounds etc.
   - Epoxies should be used to bond the overlays to the existing concrete surface

7. Give short note on Jacketing. (A–14)
   - Jacketing consists of restoring or increasing the section of an existing member by encasing it in a new concrete.
   - This method is useful for protection of section against further deterioration by providing additional to in member.

8. Give an account on how metal bonding is done on concrete member?
On the tension side of the beam 2 to 3mm steel plates are to the existing beam to increase its capacity. The glue or adhesive should compatible with the existing concert with behavioral characteristics under load addition to providing integrity with parent member.

9. How clamps are used to overcome low member strength?
The distress is due to inadequate stirrups either due to deficiency in the of provision of C- stamps, U-clamp fixed externally along the length of beam to provide adequate these will be protected by covering with rich mortar or concreting as the a later stage.

10. Define – Grouting (M -10)
Grouting can be performed in a similar manner as the injection of an epoxy. However the use of an epoxy is the better solution except where considerations for the resistance of cold weather prevent such use in which case grouting is the comparable alternative.

11. Give a short note on epoxy coatings.
- These are organic compound which when activated with suitable hardening agents form strong chemically resistant structures having excellent adhesive properties.
- They are used as binders or adhesives to bond new concrete patches to existing surfaces or hand together cracked portions.
- Once hardened, this compound will not melt, flow or bleed. Care should be taken to place the epoxy within the pot life period after mixing.

12. What are protective surface coatings?
During of concrete can be substantially improved by preventive maintenance in the form of weather proofing surface treatments. These treatments are used to seal the concrete surface and to inhibit the intrusion of moisture or chemicals.

13. List some materials used as protective surface coatings.
Materials used for this purpose include oils such as linseed oils, petroleum etc.

14. Give a brief account on routing and sealing.
- This method involves enlarging the cracks along its exposed surface, filling and finally sealing it with a suitable material.
- This is the simplest and most common technique for sealing cracks and is applicable for sealing both fine pattern cracks and larger isolated.

15. List any four causes of cracks?
- Use of unsound material
- Poor & bad workmanship
- Use of high water-cement ratio
- Freezing & thawing
- Thermal effects
- Shrinkage stresses

16. What is pneumatically applied mortar?

Pneumatically applied mortar is used for the restoration of when the location of deterioration is relatively at shallow depth. It can be used on vertical as well as on horizontal surfaces and is particularly restoring surfaces spalled to corrosion of the reinforcement. Damaged concrete elements also retrofitted using this method. This also has known as gunning or shotcreting techniques.

17. What is caging with steel?

A steel caging is prepared and made to surround the existing masonry so that lateral expansion when it is loaded in compression. The confinement of masonry will steel cage increases its capacity and ductility.

18. Give a brief note on dogs in stitching.

The dogs are thin and long and to cannot take much of compressive force. The dogs must be stiffened and strengthened by encasement in an overlay or some similar means.

19. Give some concrete materials used to overcome weathering action on concrete.

The two concrete repair materials used were

- A flow able concrete with 16 mm aggregate and containing a plasticizer and a shrinkage-compensating additive, to be cast against forms in heights up to 1.5m,
- A patching mortar to be applied rendering, for areas less than 0.01 m2.

20. What do you mean by weathering corrosion? (M– 12)

- Weathering corrosion is the agent ,which transport the abrasive material and assists the physical weathering
- Its action is aggravated during rain and when it is moving with high speed it may contain some acidic gases like co_2 fumes which may act over the material and penetrate quite deeply in the material and structure
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21. How do you arrest the leakages in RC structures? (N– 13)

The leakage will be arrested in RC structure by the following methods:

- Epoxy coating
- Cement grouting
- Chemical grouting
- Swelling type water stops

22. What is the preventive measure to be adopted to make the structure stable against marine exposure?

The following are the preventive measures adopted against marine exposure:

- Cathodic protection
- Low permeability concrete
- Uses of pozzolanic material
- Proper selection of mix design

23. What are dilapidated structures? (A– 11)
- Dilapidated structure or building is one that is in a deterioration state. it is broken-down, old and as if it was neglected.
- It is also given as a state of disrepair structure or ruin as a result of age or neglected.

24. List any four reasons for leakage of structure? (N– 12)
- Seepage in bottom / side walls
- Cracks in brick masonry or RCC works
- Rusting in concrete reinforcement
- Appearance of dampness on tank walls

25. When do we demolish a building? (N– 12)
- The building is very old and for further period it cannot be put in uses
- Whenever structural changes required
- Due to the modernization ,old building may require demolition for new construction

PART - B : (16 Marks)

1. Explain in detail, how will you improve the load carrying capacity of columns and beam with a neat sketch? (A– 14,15,M– 12,13, N– 09)
2. Explain in detail, about the different methods of strengthening the concrete structures against earthquake? (M– 13)
3. How do you asses and repair a structure distressed due to marine atmosphere? (A–15)
4. What are the methods for repair to be followed for arresting the crack in concrete structure and explain any two methods? (M – 14,N– 13)
5. Explain in detail, about jacketing and plate bonding techniques in rehabilitation to overcome the low member strength? (N–13)
6. How do you repair and rehabilitate a structure distressed due to fire? (M–12)
7. How do you strengthen the various structural elements with a neat sketch? (N –12)
8. Explain in detail, about the impulsion method of demolition of structures?
9. Discuss in detail about any case study on demolition of structures?
10. Explain in detail, how do you repair a structures distressed due to corrosion? (A–10)