# DIPLOMA IN CIVIL ENGINEERING

# SCHEME OF INSTRUCTIONS AND EXAMINATIONS

**VI Semester**

**TIME SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Subject Code | Name of the Subject | Instructionperiod / week | Total Period / year | Scheme of Examination |
| Theory | Practical | Duration (hours) | Sessional Marks | End Exam Marks | TotalMarks |
| THEORY: |
| C- 601 | Steel Structures | 5 | - | 75 | 3 | 20 | 80 | 100 |
| C -602 | Environmental Engineering - II | 4 | - | 60 | 3 | 20 | 80 | 100 |
| C -603 | Construction Technology & Valuation | 5 | - | 75 | 3 | 20 | 80 | 100 |
| C -604 | Construction Failures & Repairs | 5 | - | 75 | 3 | 20 | 80 | 100 |
| C -605 | Quality Control & Safety in Construction | 4 | - | 60 | 3 | 20 | 80 | 100 |
| PRACTICAL: |
| C- 606 | Civil Engineering Workshop | - | 3 | 45 | 3 | 40 | 60 | 100 |
| C -607 | S.E. Drawing | - | 6 | 90 | 3 | 40 | 60 | 100 |
| C -608 | Construction Technology Practice | - | 3 | 45 | 3 | 40 | 60 | 100 |
| C -609 | Project Work | - | 7 | 105 | 3 | 40 | 60 | 100 |
| TOTAL | 23 | 19 | 630 |  | 260 | 640 | 900 |

# DESIGN OF STEEL STRUCTURES

# Subject Title : DESIGN OF STEEL STRUCTURES

#### Subject Code : C-601

#### Periods/Week : 05

#### Periods/Semester : 75

# TIME SCHEDULE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No** | **Major Topics** | **No. of Periods** | **Weightage of Marks** | **Short Type** | **Essay Type** |
| 1. | Introduction and Fundamentals of Limit State Design of Steel structures | 05 | 03 | 01 | - |
| 2. | Design of fillet welded joints | 10 | 13 | 01 | 01 |
| 3. | Design of Tension members | 12 | 16 | 02 | 01 |
| 4. | Design of Compression members, Columns &Column bases | 20 | 36 | 02 | 03 |
| 5. | Design of Beams | 16 | 26 | 02 | 02 |
| 6. | Design of Roof trusses | 12 | 16 | 02 | 01 |
|  |  Total | 75 | 110 | 10 | 08 |

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

* 1. **Know the Introduction and fundamentals of limit state design of steel structures**

1.1 State common types of steel structures.

1.2 State the merits of Steel Structures.

1.3 State the demerits of Steel Structures

1.4 List the loads considered in the design of steel structures as per I.S:875-

 1987.

1.5 Describe various types of loads to be considered in the design of steel

 structures.

1.6 Understand the code of practice I.S. 800-2007

1.7 List physical properties of structural steel.

1.8 List mechanical properties of structural steel

1.9 Sketch different types of rolled steel sections

1.10 Classify cross sections of class 1 to 4

1.11 List types of elements.

1.12 Explain the Concept of Limit State Design.

1.13 Define ‘limit state’.

1.14 State types of limit states.

1.15 Define the following terms:

 1. Characteristic action,

 2. Design action and

 3. Design strength.

1.16 State the partial safety factor values for loads in limit state of strength

 and serviceability.

1.16 State the partial safety factor values for materials in limit state.

1.17 State the deflection limits for

 1. Simply supported beam,

 2. Cantilever beam and

 3. Purlins

**2.0 Understand the principles of design of Fillet Welded Joints**

2.1 State different types of joints.

2.2 Differentiate the welded joints and Riveted joints

2.3 Sketch the different forms of welded joints.

2.4 Explain the features of a fillet welded joint.

2.5 State stresses in welds as per I.S.800-2007.

2.6 State formula for design strength of a fillet welded joint.

2.7 Calculate the design strength of a fillet welded joint.

2.8 Design a fillet welded joint for a given load, thickness of a plate and

 permissible stresses as per code.

2.9 Design a fillet welded joint for a single angle connected to the gusset plate by fillet welds along the sides and at ends carrying axial loads.

2.10 Design a fillet welded joint for a double angle connected to the gusset plate by fillet welds along the sides and at ends carrying axial loads.

* 1. **Understand the principles of design of Tension Members**

3.1 Define ‘ tie’

3.2 State the applications of tension members.

3.3 Sketch different forms of tension members.

3.4 Understand the behaviour of tension members.

3.5 State the different modes of failures

3.6 Describe different modes of failures of tension members with sketches

3.7 State the maximum values of effective slenderness ratios as per code.

3.8 Determine the net effective area of single angle connected to gusset plate by welding.

3.9 Determine the design strength due to yielding of gross section, rupture of critical section and block shear failure of a single angle connected by welding

3.10 Understand design procedure of tension members.

3.11 Design a single angle tension member connected by welding only.

**4.0 Understand the principles of design of Compression Members, Columns and**

 **Column bases**

4.1 Understand the compression members

4.2 State different types of compression members (like column,strut)

4.3 Sketch different forms of compression members.

4.4 Understand the behaviour of compression members –

4.5 Classify cross sections.

4.6 Distinguish between actual length and effective length.

4.7 Define the terms 1. Least radius of gyration and 2. Slenderness ratio.

4.8 State effective lengths to be used for different end conditions.

4.9 Understand buckling class of cross section like 1. Imperfection factor and

2. Stress reduction factor for different buckling classes – column buckling curves.

4.10 State maximum values of effective slenderness ratios as per code

4.11 Understand the design compressive stress for different column buckling

 classes.

4.12 Determine the design strength of compression members

4.13 Understand design procedure of compression members.

4.14 Design columns with I sections and built up channel sections.

4.15 Understand design details - effective sectional area – codal provisions for angle struts.

4.16 Design single angle and double angle struts.

4.17 Understand codal provisions of single / double lacing and battening for built-up columns.

4.18 Design a slab base along with a cement concrete pedestal also design the welded connection.

**5.0 Understand the principles of design of Steel Beams**

5.1 Understand the concept of limit state design of beams

5.2 Define the terms:

1. Elastic moment of resistance,

2. Plastic moment of resistance,

3. Elastic section modulus,

4. Plastic section modulus and

5. Shape factor.

5.3 Determine the shape factor values for rectangular, T and I sections

5.4 Understand the behaviour of steel beams.

5.5 Classify beams based on lateral restraint of compression flange.

5.6 Determine the design strength in bending (flexure) and in shear.

5.7 List the factors affecting lateral stability – influence of type of loading.

5.8 Distinguish between web buckling and web crippling.

5.9 Understand the beams failure by flexural yielding – types.

5.10 List the types of beams failure by flexural yielding

5.11 Understand laterally supported beam – holes in tension zone – shear lag effects – design bending strength.

5.12 Understand laterally unsupported beam – lateral torsional buckling of beams (theoretical concept only – no problems).

5.13 Explain effective length of compression flanges.

5.14 Understand concept of shear in beams – resistance to shear buckling.

5.15 Understand shear buckling design methods like 1. Simple post critical method and 2. Tension field method.

5.16 Understand the design of simple beams with solid webs.

5.17 Understand component parts of plate girders with sketches

5.18 Describe different types of Stiffeners with their suitability.

5.19 Design laterally supported simply supported beam considering all codal requirements.

**6.0 Understand the principles of design of Roof Trusses**

6.1 List types of trusses – 1. Plane trusses and 2.Space trusses.

6.2 Understand the situations where roof trusses are used.

6.3 Sketch different types of roof trusses with their suitability for a given span.

6.4 Sketch a roof truss and name the component parts.

6.5 Understand the configuration of trusses like1. Pitched roof and 2. Parallel chord trapezoidal trusses.

6.6 Understand cross sections of truss members.

6.7 Understand the loads on roof trusses as per I.S – 875.

6.8 Explain the method of calculating the wind load on roof trusses..

6.9 Determine loads at nodal points of a given roof truss due to dead load, live load and wind load , given the coefficients K1, K2, K3 ,design wind speed, design wind pressure ,external and internal pressure coefficients.

**COURSE CONTENT**

**1.0 Introduction and fundamentals of limit state design of steel structures**

1.1 Merits and demerits of steel structures.

1.2 Loads considered in the design of steel structures as per I.S:875 -1987.

1.3 Introduction to I.S. 800-2007 - Mechanical properties of structural steel – yield stress (fy), ultimate tensile stress (fu) and maximum percent elongation (table -1 of IS:800-2007)

1.4 Standard structural sections – Classification of cross sections – class 1(plastic) class2(compact) class3(semi compact) and class4(slender) – types of elements –internal elements, outstands and tapered elements.

1.5 Concept of Limit State Design – limit state of strength – limit state of serviceability – classification of actions – strength – partial safety factors for loads and materials – deflection limits.

**2.0 Design of Fillet Welded Joints**

2.1 Different types of joints – lap joints – butt joints.

2.2 Differentiation of welded joints and riveted joints.

2.3 Different forms of welded joints – sketches of fillet and butt weld joints.

2.4 Fillet welded joint – detailed sketch showing the component parts.

2.5 Stresses in welds as per I.S.800-2007 – Codal requirements of welds and welding.

2.6 Problems on calculation of strength of a fillet welded joint.

2.7 Design of fillet welded joint for a given load, thickness of a plate and permissible stresses as per code.

2.8 Design of fillet welded joint for single or double angles carrying axial

 loads.

**3.0 Design of Tension Members**

3.1 Introduction to tension members and different forms of tension members.

3.2 Behaviour of tension members.

3.3 Different modes of failures – gross section yielding, net Section rupture and block shear failure.

3.4 Maximum values of effective slenderness ratios as per code.

3.5 Calculation of net effective sectional area of single angle with welded connection only.

3.6 Calculation of the design strength due to yielding of gross section, rupture of critical section and block shear – problems on single angle with welded connection only.

3.7 Design procedure of tension members.

3.8 Problems on design of tension members single angle with welded connection only.

**4.0 Analysis and design of Compression Members, columns and column Bases**

4.1 Introduction to compression members - different forms of compression

 members.

4.2 Behaviour of compression members – Classification of cross sections – class 1 (plastic) class2 (compact) class3 (semi compact) and class4 (slender).

4.3 Effective lengths to be used for different end conditions – table 11 of

 I.S:800.

4.4 Buckling class of cross section – imperfection factor and stress reduction factor for different buckling classes – column buckling curves.

4.5 Maximum values of effective slenderness ratios as per code – design compressive stress for different column buckling classes.

4.6 Calculation of design strength of compression members – problems.

4.7 Design procedure of compression members – problems on simple sections only (no builtup sections).

4.8 Design details - effective sectional area – codal provisions for angle struts – single angle and double angle – discontinuous and continuous struts.

4.9 Codal provisions of single / double lacing and battening for built-up columns (no problems).

4.10 Design of slab base along with a cement concrete pedestal, design of welded connection of base plate and column – problems.

**5.0 Analysis and design of Steel Beams**

5.1 Concept of limit state design of beams – shape factor and plastic properties of beams – Problems on shape factor.

5.2 Behaviour of steel beams – design strength in bending (flexure).

5.3 Factors affecting lateral stability – influence of type of loading-web buckling and web crippling.

5.4 Beams failure by flexural yielding – types.

5.5 Laterally supported beam – holes in tension zone – shear lag effects -– design bending strength

5.6 Laterally unsupported beam – lateral tensional buckling of beams - (theoretical concept only – no problems).

5.7 Effective length of compression flanges.

5.8 Concept of shear in beams – resistance to shear buckling.

5.9 Shear buckling design methods - simple post critical method – tension field method.

5.10 Design of laterally supported simple beams with solid webs.

5.11 Component parts of plate girders with sketches – brief description of different types of stiffeners.

5.12 Design of laterally supported simply supported beam considering all

 codal requirements.

**6.0 Design of Roof Trusses**

6.1 Types of trusses – plane trusses, space trusses.

6.2 Sketches of different roof trusses with their suitability for a given span.

6.3 Cross sections of truss members.

6.4 Loads on roof trusses as per I.S – 875.

6.5 Determination of loads at nodal points of a given roof truss due to dead load, live load and wind load, given the coefficients K1, K2, K3 ,design wind speed, design wind pressure ,external and Internal pressure coefficients.– problems.

**REFERENCE:**

1. Code of practice: IS 800-2007 BIS, New Delhi

2. Limit state Design of Steel Structures S.K. Duggal/TMH

3. Structural steel design M.L.Gambhir/TMH

4. Design of Steel Structures N.Subramanian

5. Design of Steel Structures S.S.Bhavikatti

6. Structural Engineering A.P.ArulManickam

7. Teaching Resource Material : http://www.steel-insdag.org

8. Teaching Resource Material : http://www.nptel.iitm.ac.in

# ENVIRONMENTAL ENGINEERING – II

#### Subject Title : Environmental Engineering - II

Subject Code : C-602

Periods/Week : 04

Periods/Semester : 60

# TIME SCHEDULE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No** | **Major Topics** | **No. of Periods** | **Weightage of Marks** | **Short Type** | **Essay Type** |
| 1 | Introduction to Sanitary Engg & Quantity of Sewage | 09 | 16 | 02 | 01 |
| 2 | Laying of Sewers & Sewers appurtenances | 09 | 19 | 03 | 01 |
| 3 | Characteristics of Sewage, treatment & disposal | 18 | 26 | 02 | 02 |
| 4 | Solid waste disposal and Sanitation in buildings  | 13 | 23 | 01 | 02 |
| 5 | Rural Water Supply and Sanitation | 06 | 13 | 01 | 01 |
| 6 |  Air Pollution  | 05 | 13 | 01 | 01 |
|  |  Total | 60 | 110 | 10 | 08 |

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

**1.0 Understand the basics of sanitary engineering and Quantity of sewage**

1.1 State the objectives of sewage disposal works.

1.2 Define the terms:

1. Sewage,

2. Sewer and

3. Sullage.

1.3 Explain the the following:

1. Sewerage,

2. Refuse and

3. Garbage

1.4 List the objectives of sewerage works.

1.5 List the various methods of sewage collection works.

1.6 Compare conservancy system with water carriage system.

1.7 Explain the different sewerage systems.

1.8 Compare the systems of sewerage with each other.

1.9 State system of sewerage preferable for towns with small and

 evenly distributed rainfall.

* 1. Understand which system of sewerage is used for a city like Hyderabad.

 Justify the choice.

1.11 State the main constituents of sewage for calculating quantity.

1.12 Define Dry weather flow.

1.13 State the factors affecting dry weather flow.

1.14 State the factors affecting the quantity of storm sewage.

1.15 Explain the variation in rate of sewage.

1.16 Estimate the quantity of storm water flow using 1. Rational method and 2. Emperical formulae.

1.17 List the requirements of good surface drains.

1.18 Describe different types of surface drains with their merits and

 demerits.

1.19 State the limiting velocities of flow in sewers.

1.20 Works out simple problems on design of sewers running half full only.

1.21 Explain the use of nomograms in detail in the design of sewers.

**2.0 Understand the Types of sewers, laying of sewers and appurtenances**

2.1 State various shapes of sewers.

2.2 Explain the circular sewer with a sketch

2.3 list any two merits and demerits of circular sewer

2.4 Mention different materials used for sewers.

2.5 State any two merits and demerits for each type of sewer.

2.6 Explain the method of laying the sewers as per given alignment.

2.6 State the necessity of providing sewer appurtenances on the sewer lines.

2.7 List the various sewer appurtenances on a sewer line.

2.8 Explain the necessity of providing manhole in sewer line with the help of sketch.

2.9 Explain the construction, function and location of the different sewer

 appurtenances.

* 1. State the necessity of ventilating the sewers and explain the methods of

ventilation.

2.11 State the situations under which sewage pumping is necessary.

2.12 Explain the component parts of a pumping station and factors influencing its location.

2.13 Explain the construction and working of Shone’s ejector with the help f a sketch.

 2.14 Explain the testing of sewers.

 2.15 Explain the reasons for occurance of explosions in sewers and their prevention.

**3.0 Understand the characteristics of sewage**

3.1 Define strength of sewage.

3.2 Describe the method of sampling sewage.

3.3 State the physical, chemical and biological characteristics of sewage.

3.4 Define C.O.D and B.O.D

3.5 State the significance of the following tests to Analyse sewage.

i) Solids (ii) C.O.D. (iii) B.O.D. (iv) PH-Value (v) Chlorides.

3.6 State the characteristics of industrial waste water.

3.7 Explain the principles of treatment of industrial wastewater.

3.8 State the objects of sewage treatment.

3.9 Draw the conventional sewage treatment plant of a town and indicate the main function of each unit.

3.10 State the function of screens, skimming tanks and grit chambers.

3.11 Explain the working of screens, grit chambers, skimming tanks.

3.12 Describes with sketches the following treatment works.

1. sedimentation tank.
2. Trickling filters.
3. Activated sludge process.
4. Oxidation ditch.
5. Oxidation pond.
6. Aerated lagoons.
7. Anaerobic lagoons.
8. Sludge digesters

3.13 Compare activated sludge process and trickling filters.

3.14 List out various methods of sludge disposal.

3.15 Explain the methods of sludge disposal.

3.16 Explain with sketch the treatment of sewage by septic tank and soak pit.

3.17 Determine the dimensions of a sedimentation tank and a septic tank for given data.

3.18 List the various methods of sewage disposal.

3.19 Explain the methods of disposal of sewage.

**4.0 Know the methods of disposal of solid wastes and Sanitation in Building**

4.1Define the term’ Refuse’

4.2 State the classification of solid wastes.

4.3 Explain the methods of disposal of solid wastes.

4.4 State any two merits and two demerits for each of the solid waste disposal

 methods.

4.5  Explain the meaning of composting.

4.6 Explain the methods of composting.

4.7 List the equipments required for preparation of compost by mechanical composting.

4.8 State the aims of building drainage .

4.9 State the requirements of good drainage system in buildings.

4.10 Explain the terms: soil pipe, waste pipe, vent pipe, anti- syphonage pipe.

4.11 Describe the layout of sanitary fittings and house drainage arrangements for buildings (single and multi-storied).

4.12 Explain with sketches the different types of plumbing systems.

4.13 Describe different sanitary fittings like water closets, flushing cisterns, urinals, inspection chambers, traps, anti-siphonage pipes.

4.14 Explain the procedures involved in the inspection, testing and maintenance of sanitary fittings.

**5.0 Knows the methods of rural sanitation**

5.1 Explain the process of disinfection of wells by two pot method.

5.2 List the different types of sanitary latrines.

5.3 Explain the methods of rural sanitation.

5.4 Describe with sketches the construction of sanitary latrines in rural areas.

5.5 State the advantages of bio-gas plant.

5.6 State the factors effecting production of bio-gas.

5.7 Describe the construction and working of K.V.I.C.model bio-gas plant with

 a neat sketch.

* 1. Describe the construction and working of Janata model bio-gas plant with a sketch.

5.9 Explain vermi composting..

5.10 Describe briefly the procedure of vermi composting and mention its

 advantages.

**6.0 Know the effects of air pollution and its control**

6.1 Define the term air pollution.

6.2 State the sources of air pollution.

6.3 Explain the natural and manmade sources of air pollution.

6.4 List the effects of air pollution.

6.5 Explain the effects of air pollution on human health and vegetation.

6.6 Explain the effects of air pollution on atmosphere and materials.

6.7 List the methods of control of air pollution.

6.8 Explain the method of prevention of air pollution at source.

6.9 List the various types of controlling devices and equipment.

6.10 Explain with sketches the methods of controlling air pollution by controlling devices and equipment.

6.11 Describe the control of air pollution by stacks.

6.12 Explain the method of prevention of air pollution by vegetation.

**COURSE CONTENT**

**1. Introduction and Quantity of Sewage**

1. Object of providing sewerage works.
2. Definition of terms : sullage, sewage, sewer and sewerage – classification of

 sewage.

1. System of sewage disposal - conservancy and water carriage systems.
2. Types of sewerage systems and their suitability – separate, combined and

 partially separate systems.

e) Quantity of discharge in sewers, dry weather flow, variability of flow.

f) Determination of storm water flow – run off co-efficient, time of

 concentration, rational method and empirical formulae for run-off.

1. Surface drainage - requirements, shapes, laying and construction.

h) Simple problems on design of sewers (running half full only) using

 Manning’s and Hazen Williams formulae .

i) Use of nomograms as per I.S.1742 to determine the unknown

 values of gradient, diameter, discharge and velocity.

**2. Laying of Sewers and Sewer Appurtenances**

1. Different shapes of cross section for sewers – circular and non-circular –

 merits and demerits of each.

1. Brief description and choice of types of sewers - stone ware, cast iron, cement concrete sewers and A.C Pipes.
2. Laying of sewers - setting out alignment of a sewer, excavation, checking the gradient , preparation of bedding, handling, lowering, laying and jointing, testing and back filling.
3. Brief description, location, function and construction of

 i) Manholes.

ii) Drop manholes.

1. Street inlets.
2. Catch basins.
3. Flushing tanks.
4. Regulators.
5. Inverted siphon.
6. Necessity of pumping sewage - location and component parts of a pumping station.

**3. Sewage Characteristics**

1. Strength of sewage, sampling of sewage, characteristics of sewage;

 physical, chemical and biological.

1. Analysis of sewage - significance of the following tests for (No details of tests)
2. Solids, (ii) C.O.D, (iii) B.O.D., (iv) P**H** - Value, (v) Chlorides.
3. Characteristics of Industrial waste water–principles of treatment, Reduction of volume and strength of wastewater, Equalization, Neutralization and proportioning.
4. Preliminary treatment - Brief description and functions of following units.
5. Screens, (ii) Skimming tanks and (iii) Grit chambers.
6. Primary treatment - Brief description and functions of Plain sedimentation, simple problems on the design of sedimentation tanks.
7. Secondary treatment - Brief description of
8. Trickling filters (ii) Activated sludge process (iii) Oxidation ditch

(iv) Oxidation pond (v) Aerated lagoons (vii) Anaerobic lagoons

1. Sludge digestion – Process and methods of sludge disposal.
2. Miscellaneous treatments-septic tank.
3. Sewage disposal - dilution, disposal on to lands, ground water recharge, reuse etc.

**4. Solid Waste Disposal and Sanitation in Buildings**

1. Methods of disposal - uncontrolled dumping, tipping or sanitary land fill –

 Incineration - composting.

1. Preparation of compost - equipments required such as storage hoppers, grinders, conveyors etc., in mechanical composting.
2. Aims of building drainage and its requirements – General layout of sanitary fittings to a house - drainage arrangements for single and multi-storeyed buildings as per IS code of practice-plumbing systems.
3. Sanitary fittings – traps, water closets, flushing cisterns, urinals, inspection chambers, anti siphonage - Inspection, testing and maintenance of sanitary

 fittings.

**5. Rural Water Supply and Sanitation**

1. Disinfection of wells.
2. Rural sanitation and sanitary latrines, biogas production technology -brief

 description and operational details of bio-gas plants using animal waste, night soil and agricultural wastes -KVIC and JANATA models- merits and demerits-maintenance of biogas plant.

1. Vermi composting –procedure -advantages

### 6. Air Pollution

1. Definition - sources of air pollution – effects of population.
2. Control of air pollution – methods - air pollution control at source – zoning – installation of controlling devices and equipment : internal separators, gravity settling chambers, cyclones, fabric filters, wet collection devices : cyclonic scrubbers, venture scrubbers, electrostatic precipitators - brief description of the above equipment – air pollution control by stacks – by vegetation.

**REFERENCE:**

1. Environmental Engineering G.S. Birdie
2. Elements of Public Health engineering K.N. Duggal
3. Environmental Engineering Baljeet Kapoor
4. Public Health Engineering S.K. Hussain
5. Environmental Engineering Ramachandraiah
6. Water supply and sanitary Engineering V.N. Vazirani.
7. Environmental Engineering N.N.Basak/TMH

**CONSTRUCTION TECHNOLOGY AND VALUATION**

## Subject Title : Construction Technology and Valuation

Subject Code : C-603

Periods / Week : 05

Periods / Semester : 75

# TIME SCHEDULE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S No** | **Major Topics** | **No. of Periods** | **Weightage of marks** | **Short Answer Type** | **Essay Type** |
| 1. | Concrete Technology | 20 | 29 | 3 | 2 |
| 2. | Pre stressed Concrete | 10 | 13 | 1 | 1 |
| 3. | Form Work and Reinforcement  | 08 | 13 | 1 | 1 |
| 4. | Construction Machinery and Equipment  | 08 | 13 | 1 | 1 |
| 5. | Building Services | 09 | 13 | 1 | 1 |
| 6. | Earth quake resistantStructures | 06 | 13 | 1 | 1 |
| 7. | Building Valuation | 14 | 16 | 2 | 1 |
|  | **Total** | **75** | **110** | **10** | **8** |

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

1. **Understand the concrete Technology**
	1. State the ingredients of Concrete.
	2. Define 1. Workability and 2. Water/Cement ratio
	3. Explain the relation between strength of concrete , workability and water/cement ratio
	4. Understand ‘Grades’ of concrete.
	5. State the grades of concrete recommended for different types of works.
	6. Differentiate ‘Normal strength concrete and High strength concrete’
	7. Differentiate between ‘Ordinary Concrete and Controlled Concrete’
	8. State the functions of Admixtures in concrete
	9. List out different admixtures being used.
	10. State the Principles of Concrete Mix Design.
	11. State the factors affecting variability of concrete strength.
	12. Explain the procedure of Concrete Mix design using IS Code method
	13. Understand the following special concretes

1. Fiber Reinforced Concrete,

2. Fal-G-Concrete,

3. Light weight concrete,

4. High density concrete,

5. Polymer concrete and

6. Self compacting concrete

* 1. Understand concreting under special exposure conditions like

1. Under- water concreting,

2. Cold weather concreting,

3. Hot weather concreting and

4. Concreting in high rise buildings

* 1. Explain ‘Micro concrete’ and ‘Shotcrete’.
	2. State the need for Expansion and Construction joints in concrete structures.
	3. Explain the method of providing various joints in RCC roofs.
1. **Understand the Pre stressed concrete**
	1. Understand fundamental principles of prestressed concrete.
	2. State the materials and permissible stresses.
	3. List the losses of prestress.
	4. Explain the methods of 1. Pre stressing and 2. Post- tensioning systems.
2. **Understand Form work and Reinforcement**
	1. State the Objectives of Formwork.
	2. State the requirements of formwork.
	3. List the loads to be considered for the design of formwork.
	4. Draw the formwork arrangements for

1. Slab and Beam system,

2. Column and

3. Wall

* 1. State the merits of Steel formwork over Timber formwork.
	2. State the demerits of Steel formwork over Timber formwork.
	3. State the chemical composition of structural steel as per IS.
	4. State different types of steels used for concrete reinforcement along with their mechanical properties.
	5. Explain the bond mechanism in plain and deformed bars.
1. **Understand the Construction Machinery and Equipment**
	1. Understand the need for mechanization and construction activities
	2. State different types of construction equipment
	3. Explain the uses of different construction equipment
	4. State the factors to be considered for the selection of type of construction equipment.
2. **Understand the Buildings services**
	1. Explain the hot water supply distribution using solar water heating system.
	2. State the requirements of good lighting in building.
	3. Define the terms 1. Glare and 2. Day light factor
	4. State the precautions to be taken to avoid glare in building
	5. State the requirements of good electrical wiring.
	6. List the power rating of different domestic electrical appliances.
	7. List the different types of electrical wirings.
	8. State the objectives of electrical earthing.
	9. Explain the method of earthing
	10. State the requirements of good ventilation.
	11. Explain 1. Natural ventilation and 2. Artificial ventilation.
	12. State the functions of

1. Sunshades,

2. Louvers,

3. Sun breakers and

4.Blinds

* 1. State the principles of fire protection in buildings.
	2. State the causes of fire.
	3. Explain about fire fighting.
	4. State different fire detectors and fire extinguishers.
	5. State different fire extinguishers
	6. State different fire resistant building materials.
	7. Explain about air conditioning.
	8. State different types of cooling systems.
1. **Understand Earth quake resistant structures.**
	1. List causes seismic waves, basic terminology
	2. Explain 1. Magnitude, 2. Intensity and 3. Energy release
	3. Characteristics of earthquake
	4. Understand basic terminology of Earthquake
	5. Explain seismic zoning
	6. Explain seismic construction with brick stone masonry buildings as per codal provisions.
	7. Explain seismic construction with stone masonry buildings as per codal provisions.
	8. Understand seismic construction and detailing of R.C. buildings as per codal provisions.
2. **Understand the concept of Building Valuation**
	1. Define the terms: 1. Value and 2. Cost and price
	2. State the need for valuation.
	3. Explain the following terms:

1. Depreciation,

2. Sinking fund,

3. Annuity and

4. Capitalized value

* 1. Lists different methods of valuation of buildings.
	2. Explains different methods of valuation of buildings.
	3. State methods of rent fixation of building.
	4. Explain methods of rent fixation of building.

**COURSE CONTENT**

1. **Concrete Technology**
	1. Introduction – Ingredients of Concrete – Properties of Concrete – Workability-Factors influencing workability –Water/Cement Ratio-Relation between Strength of concrete and Water/Cement Ratio.
	2. Curing of Concrete-Method of curing.
	3. Grade of concrete-Controlled concrete and Ordinary concrete-Normal strength concrete and High strength concrete
	4. Admixtures – Types of admixtures –Accelerators-Retarders-Plasticizers –Super plasticizers- Uses.
	5. Mix design – Factors influencing mix design – Methods of Mix design – IS 10262-2009 method of mix design.
	6. Special Concretes – fiber reinforced Concrete – Fal G-Concrete, high density Concrete, Light weight Concrete, polymer Concrete and micro Concrete – Self Compacting Concrete-Properties – uses.
	7. Concreting under special exposure condition – cold weather Concreting – hot weather Concreting – under water concreting – Shotcrete – Concreting in high rise buildings.
	8. Joints – Necessity of joints – Joints in RCC roofs – Expansion joint – Contraction joint – Construction joint.
2. **Prestressed Concrete**
	1. Introduction – Basic principles – Systems of prestressing – Types of prestressing – Advantages and Disadvantages.
	2. Requirements of steel and concrete for prestressed concrete.
	3. Losses of Prestress.
	4. Tensioning devices – Method of Prestressing – Pre tensioning system – Post tensioning systems – Freyssinet, Magnel-Blaton, Gifford Udal and Lee McCal Systems.
3. **Form work and reinforcement**
	1. Objectives of form work – Loads acting on form work – Component parts of ordinary form work for columns, beams and slabs.(with sketches)
	2. Types of formwork based on the material used –Wooden form work-Steel form work.
	3. Cleaning and treatment of forms – Stripping time – tolerances.
	4. Slip form work for towers and Form work for Lining of canals.
	5. Reinforcement – types – Properties as per IS.
	6. Bending, Fixing, Placing, Tieing and Welding.
4. **Construction machinery and equipment**
	1. Need for use of construction Machinery.
	2. Factors affecting selection of equipment.
	3. Types – Crawler and Pneumatic tyred.
	4. Excavation equipments – Tractors, Bulldozer, Grader, Scrapper, Shovel, Dragline, Clamshell, Dredgers – description-Uses.
	5. Compaction equipments – Rollers, Tamping roller – Smooth wheeled roller – Pneumatic tyred rollers – Vibrating compactors – Description – uses.
	6. Hauling equipments – Trucks, Dump trucks, Dumpers.
	7. Cranes –Tower cranes.
	8. Conveying equipments – Belt conveyors.
5. **Building Services**
	1. Hot water supply using solar water heating system.
	2. Lighting requirements in a building – daylight factor – glare.
	3. Electrical services – Requirements of good electrical wiring – types of electrical wirings – earthing – methods.
	4. Ventilation – Requirement of good ventilation – Natural and Artificial ventilation – purpose of sunshades, louvers, and blinds.
	5. Air conditioning – Purpose – Air conditioning layout – Components –Types of cooling systems – Air coolers – Air conditioner – Centralized Air conditioner – Split type Air Conditioner.
6. **Earth quake resistant structures**
	1. Causes of seismic waves – Magnitude, intensity and energy release – basic terminology – Characteristics of earthquake – seismic zoning.
	2. Seismic construction of brick and stone masonry buildings – Provisions of I S : 4326.
	3. Seismic construction of R.C. Buildings – Detailing as per Provisions of I S : 13920.
7. **Building Valuation**
	1. Definition – Value, Cost and Price, Scrap value, Salvage value, Market value, Book value, Sinking fund and its meaning – purpose of valuation – factors governing valuation.
	2. Depreciation – Sinking fund – Annuity – Capitalized value.
	3. Methods of valuation – Land & building method, Development method, Depreciation method, Rental method, Capitalization method, Profit method, Simple problems on each of the above method.
	4. Rent fixation – Rent fixation of building – principles of rent fixation by CPWD – Fair rent method – simple problems.

**REFERENCE:**

1. Prestressed Concrete N Krishna Raju(Mc Graw Hill,

New Delhi)

1. Concrete Technology M S Shetty

###### Building Technology and valuation TTTI, Chennai

1. Hand book on Design of Concrete mixes ‘S.P.23’ BIS, New Delhi
2. Valuation of Real Properties S.C.Rangwala

# CONSTRUCTION FAILURES, REPAIRS AND MAINTENANCE

Subject Title : Construction failures, repairs and maintenance

Subject Code : C-604

Periods/ week : 05

### Periods/year : 75

**TIME SCHEDULE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl.No.** | **Major Topics** | **Periods** | **Weightage of Marks** | **Short Answer Type** | **Essay Answer Type** |
| 1. | Introduction | 02 | 03 | 1 | -- |
| 2. | Subsurface construction failures and repairs | 15 | 16 | 2 | 1 |
| 3. | Surface construction failures and repairs | 08 | 13 | 1 | 1 |
| 4. | Masonry and concrete failures, repairs | 15 | 26 | 2 | 2 |
| 5. | Manmade and Natural failures, rehabilitation | 15 | 26 | 2 | 2 |
| 6. | Maintenance problems and their solutions | 20 | 26 | 2 | 2 |
|  | Total | 75 | 110 | 10 | 08 |

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

1. **Introduction**
	1. Define

1. Error,

2. Defect and

3. Failure

* 1. State different types of errors causing failures.
	2. State the causes of failures.
1. **Understand subsurface construction failures and repairs**
	1. Describe construction failures in foundations – Under mining safe support – Load transfer failure – Lateral movement – Unequal support – settlement and differential settlement – Uplift in expansive soils – Design error – Construction error – flotation and water change – vibration effect – earthquake effect.
	2. Describe the repairs involved for rectifying the above failure.
	3. Describe Sub surface construction failures – Trenches, sheeting and bracing, piles and caissons – Sewer and tunnels, dams.
	4. Describes the repairs involved for rectifying the above failures.
2. **Understand Surface construction failures and repairs**
	1. Describes the following types of failures in surface construction – Slopes and slides – Subsidence of retaining walls and abutments.
	2. Describes the repairs involved for rectifying the above failures.
3. **Understand Masonry and concrete failures, repairs**
	1. Describe types of failures in masonry – Wall failure, construction error, aging, joints and cracks, weather tightness, masonry cladding, partitions, ornamental screens, plaster.
	2. Explain the repairs involved for rectifying the above failures.
	3. Explain the types of failures in concrete – Improper mix design, curing, placement of reinforcement, Rusting of embedded steel, handling of pre cast elements, shrinkage, expansion and plastic changes, surface disintegration due to fire, spalling of concrete, compression failure, erection difficulty, temperature change, Deformation and cracking – repairs.
	4. Explain the repairs involved for rectifying the above failure- use of expansion filler.
4. **Understand Manmade and natural failures and repairs**
	1. Describe the following types of failures in manmade and natural disasters.
	2. Demolition, deterioration, overload, alteration collapses, fire, explosion and vibration, collision, wind damages, towers and masts, storm at sea, storm on land, lightening damage, rain-ponding effect – Explain the repair’s involved for rectifying the above failure.
	3. Describe the failures due to ignorance and negligence – Ignorance, or incompetence, negligence, control and supervision, responsibility.
	4. Explain the repairs involved for rectifying the above failures.
5. **Understand the Maintenance problems and their solutions**
	1. Describes the list of defects in buildings bringing out the investigation and remedial details.
	2. State the methods of solving dampness problems in buildings.
	3. Explain the causes, preventive and corrective methods of cracks in building.
	4. Explain the maintenance operations for the Water supply and sanitary components of building.
	5. Explain the methods of maintenance of roads / road berms / side drains.
	6. Explain methods of repairs to canal linings.
	7. Use of Leak proof chemicals for R.C.C roofs.

**COURSE CONTENT**

1. **Introduction**
2. Definition of error, defect, failure – Causes of failures.
3. **Sub-surface construction failures and repairs**
4. Failures in Foundations – Under mining – Load transfer failures – Lateral movement – Unequal support – Settlement and Differential Settlement – Uplift in expansive soils compression failure, erection difficulty, temperature change, Deformation and cracking – Drag down and heave – Design error – Construction error – Flotation and water change – Vibration effect – Earthquake effect – repairing techniques to be adopted.
5. Failures during excavation – Sheeting and bracing – piles and caissons – sewers and tunnels – measures to be taken.
6. **Surface construction failures and repairs**
7. Earthen bunds – failures – slope failures and sliding – subsidence – measures to be taken to prevent surface construction failures – measures to be taken – retaining walls and abutments – geo-membranes – Rivetment and pitching.
8. **Masonry and concrete failures, repairs**
9. Wall failures – Construction error – Aging – Joints and cracks – Water tightness – Masonry cladding – Partitions – Ornamental screens – Plastering failures - repairs.
10. Concrete failures – Improper mix design, curing, placement of reinforcement and handling of pre cast elements – shrinkage failures – expansion and plastic changes – surface disintegration due to fire – spalling of concrete – repairs.
11. **Man-made and natural failures, rehabilitation**
12. Demolition – Deterioration – Overload – Alteration collapses – Fire – Explosion and Vibration – Collision – wind damages of towers and masts – Storm at sea – Storm on Land – Lighting damage – rain-ponding – effects – rehabilitation measures.
13. **Maintenance problems and their solutions**
14. Water proofing, leakage of basements and roofs – Treating dampness in walls – Omission of DPC – Window sills, down pipes and other areas of damp penetration – Cico water proofing.
15. Cracks in walls – Horizontal, Vertical, diagonal – causes and prevention of cracks in buildings – Care of floors, removing stains from floors – Inks, rust, oil, paint and varnish.
16. Maintenance problems of plumbing, heating, hot water supply, clogged drains, sewers, leaking pipe joints, electrical installations, other building services, septic tanks and soak pits.
17. Maintenance of roads, road-berms and side drains.
18. Strengthening of canals, embankments, silt clearance weed removal, repairs to canal lining.
19. Leak proofing of water tanks and roofs use of chemicals for RCC roofs.

**REFERENCE:**

1. Construction Failure Jacob Feld

 (John Wiley & Sons, New York, London)

1. Failures & Repairs of Concrete Structure S. Champion

 (John Wiley & Sons, New York, London)

1. Engineering Structural Failures Rolt Hammond (Odham Press, London)
2. Learning from Failures Raikar
3. Building Failures Diagnosis and Avoidance by Ran Son W.H. – Publishing E and F.N. Span.
4. Maintenance Engineering for Civil Engineers Nayak B.S.,

 (Khanna Publishers, Delhi}

1. SP: 25-1987 Causes and prevention of cracks in buildings BIS, New Delhi

**QUALITY CONTROL & SAFETY IN CONSTRUCTION**

Subject Title : Quality control & Safety in construction

Subject Code : C-605

Periods/ week : 04

### Periods/year : 60

 **TIME SCHEDULE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl.No** | **Major Topics** | **No. of****Periods** | **Weight age of Marks** | **Short Answer Type** | **Essay Type** |
| 1 | Specifications and Standards | 12 | 26 | 2 | 2 |
| 2 | Quality control | 06 | 13 | 1 | 1 |
| 3 | Statistical Analysis and Tolerance | 06 | 13 | 1 | 1 |
| 4 |  Introduction to safety in construction Activities | 06 | 16 | 2 | 1 |
| 5 |  Causes of Accidents and Safety Measures | 24 | 29 | 3 | 2 |
| 6 | Prevention of accidents | 06 | 13 | 1 | 1 |
|  |  Total | 60 | 110 | 10 | 08 |

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

* 1. **Know different specifications and standards**
	2. State different specifications of buildings.
	3. Explain functional aspects of different structures.
	4. Describe detailed specification for various items of work.
	5. Prepare detailed specification from general description.
	6. List relevant IS codes.
	7. Identify sizes for building components.
	8. Identify standards.
	9. Understand standards for industrial buildings.
	10. Explain Management aspects of quality control.
	11. Describe Advisory Organization.
	12. Describe Management Functions and Regulations.
	13. State PWD & CPWD Guidelines for field officers.
	14. **Understand the production and Quality control of construction works and Tolerance levels**
	15. Describe control aspects of batching and mixing.
	16. Explain the inspection of reinforcement grills.
	17. Explain the inspection and examination of formwork.
	18. Describe the quality of the filler materials.
	19. Establish relationship between the strength of brickwork and strength of mortar.
	20. **Understand statistical basis for modern quality control**
	21. Describe Mathematical probability.
	22. Describe sampling plan.
	23. Explain sampling risks of acceptance and rejections.
	24. State the tolerances levels in construction industry.
	25. Understand visual appearance.
	26. State the dimensional accuracies.
	27. **Understand the safety aspects to be taken in construction works**
	28. Describe the safety requirements against fire hazards
	29. Describe the safety while using construction machinery
	30. Describe the safety during the demolition of buildings
	31. Describe the preventive methods of accidents
	32. **Understand the causes of Accidents and Safety measures**
	33. Define accidents.
	34. List the causes of accidents.
	35. Role of loss control approach in the cost of the accidents.
	36. Describe the cost aspects of accidents and measures.
	37. Describe the General safety program.
	38. Prepare accidents reports.
	39. Describe the safety measures to be taken for storage and handling of building materials.
	40. Describe the safety requirements in formwork and scaffolding.
	41. Explain the safety in excavation & pile driving in foundation.
	42. Describe the safety measures to be taken in construction of building elements.
	43. Describe the safety measures to be taken in demolition of buildings.
	44. Describe the safety measures to be taken for hot bituminous works.
	45. Describe the safety measures to be taken in supporting structural work.
	46. **Understand the Planning for accident prevention**
	47. Define 1. Risk and 2. Risk management.
	48. Explain the role of risk management.
	49. Describe the planning for accident prevention.
	50. Evaluate risks and losses and cost control works
	51. Describe the management measures for controlling losses

**COURSE CONTENT**

**Quality Control**

* 1. (a) Specification for buildings – functional aspects of residential, commercial and industrial structures – Detailed Specifications for various items of work – preparation of detailed specification from general description – Modular Coordination – relevant IS codes – Preferred size for building components – Performance standards – Standards for industrial buildings.

(b) Management aspects of quality control – advisory organization management functions – Statutory regulations – State PWD & CPWD guide lines for field officers.

* 1. (a) Production & quality control of concrete – general – batching – mixing – inspection of reinforcement grill and form work.

(b) Quality control in Masonry works – quality of filler materials – Brick – stone – quality of mortar – relation between strength of brick work Vs strength of bricks Vs strength of mortar.

* 1. (a) Statistical basis for modern quality control – Simple examples of mathematical probability – Sampling plan – Sampling risks of acceptance and rejection.

(b) Tolerance levels in construction industry – Visual appearance – dimensional accuracies.

**Safety**

* 1. Introduction – safety against fire hazards – Fire & fire fighting – Fire rating of building materials – fire prevention standards – safety in use of construction machinery – lifting machinery, earth moving machinery and conveyors, demolition of buildings – Loading standards for buildings – The safety programme – Accident due to fall – preventive methods.
	2. (a) Causes of accidents – Classification of construction accidents – Cost of accidents – loss control approach in the cost of accidents – measurement of accidents – Salient features of ‘A safety programme’ – General safety programmes for construction – Accident report.

(b) Safety Measure for storage & handling of building materials – Safety Measure in construction of elements of building – Safety in excavation & pile driving –foundations – form work – scaffolding – roofing – safety on fragile roof – other items of work – Safety Measure in demolition of buildings – Safety Measure for hot bituminous works – Safety Measure for scaffolding, Ladders form work and other equipment – erection of prefabricated components and transportation – erection of steel structures – Safety measures for excavation.

* 1. Planning for accident prevention – evaluation of risk and loss potential in the work. vis-a-vis cost of control measures – loss control approach through accident prevention and other risk management measures for controlling losses due to personnel, legal, liability losses – property losses.

**REFERENCE:**

1. Design of Foundations & Detailing Er.A.Veerappan & Er. A.Pragadeeswaran

2. Specification Writing A.J and C.J.Willis (Crossby Lockwood,

London)

3. Quality Control and Reliability Norbert L Enrick (Industrial Press Inc.,NY)

4. Standards in Buildings R.Nagarajan (Pitman publishing, 1976)

5. Safety in Construction Industry-OSHA Vincent G.Bush

6. Estimation and Costing Dutta

7. Safety in Construction Industry S.Purushotham & G.Vaidyanathan

(Central Labour Institute, Bombay)

8. Accident Prevention in Construction Associated General Contractors of America

9. Standards on safety BIS, New Delhi

10. Construction Planning and Management Shrivastava U.K

(Galgotia Publications,New delhi)

13.Design and Construction failures DOV Kamimanetzky

(Galgotia publications, New Delhi)

#

## CIVIL ENGINEERING WORK SHOP

Subject title : Civil Engineering Workshop

Subject code : C-606

Periods / Week : 03

Periods / Semester : 45

# TIME SCHEDULE

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | Major Topic | **No. of periods** |
| 1 | Carpentry | 5 |
| 2 | Bar Bending of steel reinforcement | 10 |
| 3 | Plumbing exercises | 10 |
| 4 | Electrical Exercises | 20 |
| Total | 45 |

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

1. **Understand the elements of carpentry in connection with the erection of scaffolding and form work with a particular reference to use of braces**
	1. State various components of scaffolding
	2. State precautions to be taken while erecting scaffolding
	3. Explain the method of fixing various elements of scaffolding
	4. State precautions to be taken to fix the various elements of scaffolding at required position.
	5. Connect various elements of scaffolding.
	6. Explain various aspects of form work to be considered while fixing various elements
	7. Explain the method of fixing of form work at required position for various elements of building construction
	8. Connect various elements of formwork.
2. **Understand the skills of bending of reinforcing bars as per the bar bending schedule**.
	1. Identify various tools used for bending of reinforcing bars.
	2. Read the data required from bar bending schedule for bending of bars.
	3. Mark the salient points of location of bending on the bars as per the bar bending schedule.
	4. Bend the bars using the specified tools to the exact shape as per bar bending schedule as specified in IS-2502(Code of practice for bending and fixing of bars for concrete reinforcement)

2.5 Prepare the grills as per the drawings of the structural elements using binders, stirrups, links etc. appropriate to the element.

**3.0 Understand the elements of plumbing practice and procedure of fixing of various plumbing fixtures**

3.1 Identify the different pipe specials and state their functions

3.2 Practice thread cutting on PVC/GI pipes

3.3 Assemble the pipe line for toilet block with taps, showers and wash basins using specific pipe specials.

3.4 Fix the floor trap, gully trap and water closet of a house to the drainage pipes.

**4.0 Understand the various aspects of electrical installations used in buildings and their fixing at appropriate locations**

4.1 Identity various electrical accessories, Wires and cables

a. Mains switch

b. MCB

c. Fuse

d. Switches (SPST SPDT)

e. Rotary switch

f .Push Button Switches

g. 2 pin Sockets

h. 3pin /Power sockets

i. Ceiling Rose

g. Lamp Holders.

(a) Identify line, neutral and earth terminals in power sockets and power

 plugs by physical observation and using Tester

h. Use of test lamp

* 1. Identify different wires and cables

 a. Know the wire gauge

b. Specifications of electrical wires

c. VIR, PVC, TRS wires

d. Flexible wires and cables

e. Power cords.

* 1. Study of earthing and earth pit
	2. Study of different wiring systems
		+ 1. Open conduit system
			2. Concealed conduit system
	3. Use of Digital Multimeter to

a. Identify the Range selector

b. Selection of appropriate range to measure

1. AC Voltage
2. DC Voltage (Battery)
3. AC Current (Through a lamp/heater)
4. Check continuity
5. Resistance
	1. Connect a fuse in the main circuit

a. Know the metals suitable for fuse wire

b. Selecting a correct fuse wire rating for a given electrical load

* 1. Connect a low current (3A) MCB in the circuit and testing
	2. Control the lamp using a switch
	3. Control the fan with a switch and regulator
	4. Connect a i) 2-pin socket ii) 2-pin socket with switch control
	5. Control one lamp with 2 switches (Staircase wiring)
	6. Know Power consumption of various Appliances like

1. Tungsten Lamp

2. CFL Lamp

3. Fan.

4. Fluorescent lamps (Tube Lights).

5. Air cooler

6. Water heater,

7. Geiser

8. Electric Iron

* 1. Estimate the total connected load
	2. Study of inverter/UPS wiring
	3. Electrical estimation and costing
	4. Study of 3-phase system

**KEY Competencies to be achieved by the student**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Experiment Title** | **Competencies** | **Key Competency** |
| 1 | Fixing of scaffolding | * Measuring lengths of props accurately
* Fixing braces at required locations correctly to support various other scaffolding members
* Choosing suitable size of members to support load coming over the scaffolding
 | * Measuring lengths of props accurately
* Choosing suitable size of members to support load coming over the scaffolding
 |
| 2 | Positioning of form work | * Adjusting the lengths of props correctly to support the weight of RCC elements
* Fixing up of various elements of form work firmly to support the weight of RCC elements
 | * Fixing up of various elements of form work firmly to support the weight of RCC elements
 |
| 3 | Bar Bending of steel reinforcement  | * Cutting of rods to the suitable lengths correctly
* Maintaining the angle of cranking correctly
* Maintaining required spacing of rods as per the design and drawings provided
 | * Cutting of rods to the suitable lengths correctly
* Maintaining the angle of cranking correctly
 |
| 4 | Plumbing Exercises | * Using appropriate tools
* Selection of suitable pipe specials
* Making connections to various sanitary installations
 | * Making connections to various sanitary installations
 |
| 5 | Electrical Exercises | * Adopting suitable type of electrical fixtures for intended usage
* Using suitable material in required quantities for making earthing for an electrical installation
 | * Using suitable material in required quantities for making earthing for an electrical installation
 |

## COURSE CONTENT

**1. Carpentry**

1. Erection of Scaffolding Material
2. Position of Shuttering
3. Fixing of form work.

**2. Bar Bending of steel reinforcement**

Preparation of bar bending schedule

1. Bar bending with bar bending schedule
2. Method of bar bending for Earthquake resistant structures
3. Filed visit to automated bar bending
4. **Plumbing exercises**
5. Thread cutting on GI/PVC pipes
6. Assembling of pipe lines for toilet with two taps, shower and wash basin
7. Fixing of floor traps, gully traps, water closet, drain pipes
8. Laying stoneware/PVC pipes and construction of inspection chambers
9. **Electrical Exercises**
10. Identity various electrical accessories
11. Identify line, neutral and earth terminals in power sockets and power plugs
12. Measure the AC voltage between line and neutral using DMM
13. Study of earthing and earth pit
14. Study of different wiring systems
	* + 1. Open conduit system
			2. Concealed conduit system
15. Measurement of the following using DMM
	* + 1. AC Voltage
			2. DC Voltage (Battery)
			3. AC Current (Through a lamp/heater)
			4. Check continuity
			5. Resistance
16. Connecting a fuse in the main circuit
17. Controlling the lamp using a switch
18. Controlling the fan with a switch and regulator
19. Connect a i) 2-pin socket ii) 2-pin socket with switch control
20. Control one lamp with 2 switches (Staircase wiring)
21. Study of inverter/UPS wiring
22. Electrical estimation and costing
23. Study of 3-phase system

STRUCTURAL ENGINEERING DRAWING

Subject Title : Structural Engineering Drawing

## Subject Code : C-607

Periods / Week : 06

## Periods / Semester : 90

# TIME SCHEDULE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Major Topics** | **No. of Periods** | **Weightage of marks** | **Short Type** | **Essay Type** |
| 1. | Structural Planning and marking of Frame components | 09 | 04 | 01 | - |
| 2. | R.C.C. Drawings | 42 | 28 | 02 | 01 |
| 3. | Reading and interpretation of Structural Drawings | 09 | 04 | 01 | - |
| 4. | Steel Drawings | 30 | 24 | 01 | 01 |
| Total | 90 | 60 | 05 | 02 |

NOTE: All questions are to be answered. Part-A: 5X4=20 marks & Part-B: 2X20=40 marks

NOTE: Use HYSD bars for main reinforcement**.**

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

1. **Understand structural planning of a building and marking of Frame components**
	1. Understand Positioning and Orientation of columns
	2. Understand Positioning of beams
	3. Understand Spanning of slabs
	4. Explain layout of stairs
	5. List types of footings
	6. Prepare member reference scheme of given building following
	7. Column reference scheme and
	8. Grid reference scheme (Scheme recommended by IS:5525 – recommended for detailing of reinforced concrete works and SP-34)

.

**2.0 Draw the detailed working drawings of R.C.C.**

2.1 Draw the longitudinal section and cross sections of singly reinforced simply supported beam.

2.2 Prepare schedule of reinforcement and quantity of steel for singly reinforced simply supported beam

 2.3 Draw the longitudinal and cross section of lintel cum sunshade

2.4 Prepare schedule of reinforcement and quantity of steel for lintel cum

 sunshade

2.5 Draw the plan and longitudinal section of one-way slab showing

 reinforcement details.

2.6 Prepare schedule of reinforcement and quantity of steel for one-way slab

 showing reinforcement details

2.7 Draw the details of reinforcement of two-way simply supported slab with

 corners not held down condition.

2.8 Draw top and bottom plan and section along short and long spans of two-

way simply supported slab with corners not held down condition

2.9 Prepare schedule of reinforcement of two-way simply supported slab with

corners not held down condition

 2.10 Draw the details of reinforcement of two-way simply supported slab with

 corners held down conditions.

2.11 Draw top and bottom plan and section along short and long spans have to

 be drawn. (Scheduling of reinforcement is not necessary).

2.12 Draw the details of reinforcement of one-way continuous slab along with T- beam with details of slab and T-beam (plan and section of continuous slab and longitudinal section of T-beam have to be drawn). (Scheduling of steel is not necessary)

2.13 Draw the details of column and square footing (plan and sectional elevation) prepare schedule of reinforcement of column and footing and quantity of steel required.

2.14 Draw the reinforcement details of dog legged stair case (section only) repare schedule of reinforcement for one flight including landing.

**3.0 Read and interpret the drawings**

3.1 Understand the details of reinforcement from the given drawings

3.2 Fill in the details of reinforcement in a drawing.

**4.0 Draw the detailed working drawings of steel structures**

 4.1 Draw the sectional plan, elevation and cross section of built up

 beam showing the details of curtailment of plates and connection details.

 4.2 Draw the details of built up column with lacing and batten system

showing the details of connections by welding (plan, elevation with three systems of lacing/batten systems)

 4.3 Draw the details of steel column base with details of gusset plate. Plan, section parallel to web, section parallel to flange showing the connections with welded joints.

4.4 Draw the details of Fan roof truss with angular and tubular sections along with details of connections at ridge, heel, bottom chord and roof coverings (welded connections).

4.5 Draw the details of reinforcement of frame designed as earth quake resistant structure.

**COURSE CONTENT**

1. a) Draw the position of columns, beams, slabs, stairs and footing in a

given line diagram of building

* 1. Prepare member reference scheme of given building following
1. Column reference scheme as per IS:696 code of practice for

general engineering drawing.

1. Grid reference scheme as per IS:5525 – recommendations for detailing of reinforced concrete works.
2. Singly reinforced simply supported rectangular beam.
3. Lintel cum sunshade.
4. Simply supported one-way slab.
5. Two-way slab simply supported corners not held down.
6. Two-way slab simply supported corners held down.
7. One-way continuous slab and T-beam (with details of slab and

T-beam)

1. Column with square footing of uniform thickness.
2. Stair case – stairs spanning longitudinally (Dog legged stair case)
3. Built up beam with two cover plates with details of curtailment of plates.
4. Built up column with lacing and battening systems.
5. Gusseted column base (with welded connections),
6. Fan roof truss – 8 m span with angular and tubular sections connected by welding.
7. Frame showing the details of reinforcement for earth quake resistant structures.

**REFERENCE:**

1. Designing and Detailing hand book SP-34 BIS, New Delhi

**CONSTRUCTION TECHNOLOGY PRACTICE**

Subject Title : Construction Technology Practice

### Subject Code : C-608

Periods/ Week : 03

### Periods/Semester : 45

## TIME SCHEDULE

|  |  |  |
| --- | --- | --- |
| Sl.No | List of Experiments | No. of periods |
|  | **Tests on Road Aggregate** | 15 |
| 1 | Specific Gravity of fine and coarse aggregate |
| 2 | Impact value of coarse aggregate |
| 3 | Crushing value of coarse aggregate |
| 4 | Abrasion value of coarse aggregate |
| 5 | Flakiness Index of coarse aggregate |
| 6 | Elongation Index of coarse aggregate |
|  | **Tests on Concrete** | 20 |
| 7 | Slump test on concrete |
|  | 1. Study the changes in workability by adding cement paste to poorly workable concrete
 |
|  | 1. Study the changes in workability by adding dry cement to poorly workable concrete
 |
| 8 | Compaction factor test on concrete |
|  | 1. Study the changes in compactor of a poorly workable concrete by admixtures
 |
|  | 1. Study the methods of enhancing workability of concrete without using any admixtures
 |
| 9 | Casting of Cement concrete cubes |
| 10 | Testing of cement concrete cubes for compression |
|  | 1. Compare the compressive strengths of concrete cubes made and cured with potable water and concrete cubes made and cured with non-potable water
 |
|  | 1. Compare the compressive strengths of concrete cubes made with gap graded coarse aggregate and that made with well graded coarse aggregate
 |
| 11 | Split Tensile Strength of concrete |
| 12 | Design mix of concrete proportion |
|  | **Non-destructive tests on concrete** | 5 |
| 13 | 1. Surface hardness test(Rebound hammer)
 |
| 14 | 1. Ultrasonic test
 |
|  | **Tests on Soil** | 10 |
| 15 | Sieve Analysis – Classification of soil |
| 16 | Field Density of soil(Sand Replacement Method) |
| 17 | Proctor Compaction Test |
|  | Total: | 45 |

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

* 1. **Determine suitability of given sample of aggregate for road construction**

 **Specific Gravity of fine and coarse aggregate**

* 1. Study the importance of specific gravity of fine and coarse aggregate
	2. State the range of specific gravity values for various naturally available fine and

 coarse aggregate

* 1. Use the apparatus required for conducting specific gravity test on both fine and

 coarse aggregate

* 1. Perform the specific gravity tests for both fine and coarse aggregate

**Impact value of coarse aggregate**

* 1. Study the significance of impact value of aggregate used for road construction
	2. State the standards on impact value of aggregate used for various civil engineering works as per IS-383
	3. Use the apparatus required for conducting impact test on aggregate
	4. State the procedure for preparing the sample and no.of samples required for the given work
	5. Explain the procedure for conducting impact test on aggregate
	6. Perform impact test on given sample of coarse aggregate
	7. Draw inferences by conducting impact test on different types of natural aggregate

**Crushing value of coarse aggregate**

* 1. Study the significance of crushing value of aggregate used for various civil engineering works
	2. State the standards on crushing value of aggregate used for various civil engineering works as per IS-383
	3. Use the apparatus required for conducting crushing test on aggregate
	4. State the procedure for preparing the sample and no.of samples required for the given work
	5. Explain the procedure for conducting crushing test on aggregate
	6. Perform crushing test on given sample of coarse aggregate
	7. Draw inferences by conducting crushing test on different types of natural aggregate

**Abrasion value of coarse aggregate**

* 1. Study the significance of abrasion value of aggregate used for various civil engineering works
	2. State the standards on abrasion value of aggregate used for various civil engineering works as per IS-383
	3. Use the apparatus required for conducting abrasion test on aggregate
	4. State the procedure for preparing the sample and no.of samples required for the given work
	5. Explain the procedure for conducting abrasion test on aggregate
	6. Perform abrasion test on given sample of coarse aggregate
	7. Draw inferences by conducting abrasion test on different types of natural aggregate

**Flakiness Index of coarse aggregate**

* 1. Study the significance of flakiness index of aggregate on strength and workability properties of concrete
	2. State the standards on flakiness index of aggregate
	3. Use the apparatus required for conducting flakiness index of coarse aggregate
	4. Explain the procedure for conducting the flakiness index test on coarse aggregate

**Elongation Index of coarse aggregate**

* 1. Study the significance of elongation Index of aggregate on strength and workability properties of concrete
	2. State the standards on elongation Index of aggregate
	3. Use the apparatus required for conducting elongation Index of coarse aggregate
	4. Explain the procedure for conducting the elongation Index test on coarse aggregate
	5. Determine suitability of fresh and hardened concrete for the given conditions of workability and strength
	6. Study the importance of workability on strength properties of concrete
	7. State various types of tests used for measuring the workability of fresh concrete
	8. State standards on workability of concrete used for different places of construction work

**Slump cone test**

* 1. Use apparatus required for conducting slump test
	2. Explain the procedure for conducting slump test of workability
	3. Perform slump test on the concrete made of given sample of ingredients
	4. Draw inference from test results on slump test of workability of concrete made with coarse aggregate having different elongation index
	5. Draw inference from test results on slump test of workability of concrete made with coarse aggregate having different flakiness index
	6. Compare the slumps of concrete made with gap graded coarse aggregate and well graded coarse aggregate
	7. Study the changes in workability by adding cement paste to poorly workable concrete
	8. Study the changes in workability by adding dry cement to poorly workable concrete

**Compaction factor test**

* 1. State the purpose of compaction of concrete
	2. Use apparatus required for conducting compaction factor test
	3. Explain the procedure for conducting compaction factor test of workability
	4. Perform compaction factor test on the concrete made of given sample of ingredients
	5. Draw inference from test results on compaction factor test of workability of concrete made with coarse aggregate having different elongation index values
	6. Draw inference from test results on compaction factor test of workability of concrete made with coarse aggregate having different flakiness index values
	7. Compare the compaction factors of concrete made with gap graded coarse aggregate and that made with well graded coarse aggregate
	8. Study the changes in compactor of a poorly workable concrete by admixtures
	9. Study the methods of enhancing workability of concrete without using any admixtures

**Casting of Cement concrete cubes**

* 1. Study the purpose of casting of concrete cubes
	2. Use equipment required for casting of cement concrete cubes
	3. Explain the procedure for casting concrete cubes
	4. Cast the concrete cubes with given ingredients

**Testing of cement concrete cubes for compression**

* 1. Study the importance of testing concrete cubes
	2. Use equipment required for conducting compression test of concrete cubes
	3. State the precautions to be taken for testing of concrete cubes
	4. Explain the procedure for conducting compression test on concrete cubes
	5. Draw inference from test results on compressive strength of concrete cubes made with coarse aggregate having different elongation index values
	6. Draw inference from test results on compressive strength of concrete cubes made with coarse aggregate having different flakiness index values
	7. Compare the compressive strengths of concrete cubes of concrete made with gap graded coarse aggregate and that made with well graded coarse aggregate
	8. Compare the compressive strengths of concrete cubes made and cured with potable water and concrete cubes made and cured with non-potable water

**Split Tensile Strength of concrete**

* 1. Study the importance of split tensile strength of concrete
	2. Cast the concrete cylinders with given ingredients
	3. Explain the procedure for conducting split tensile strength test on concrete cylinders
	4. Perform split tensile strength test on concrete cylinder

**Design mix of concrete proportion as per IS: 10262 - 2009**

* 1. Study the various elements of design mix of concrete as per IS:10262-2009
	2. Conduct tests to find specific gravity, bulk density and sieve analysis of aggregate for the preparation of design mix of concrete
	3. Write the procedure for mix design of concrete
	4. Calculate the proportions of ingredients of concrete as per IS:10262-2009
	5. Cast cubes of trail mixes to decide the proportion of concrete
	6. Perform the compression tests on concrete cubes casted as per design mix
1. Understand the significance of various non-destructive tests on concrete
	1. State the importance of non-destructive tests
	2. State the apparatus/equipment required for the non-destructive tests
	3. Explain the procedure for conducting non-destructive tests
	4. Perform the non-destructive tests like Rebound hammer tests, ultrasonic tests on the given hardened concrete
	5. Record the observations of tests
	6. Draw the inferences from the test results
2. **Determine various engineering properties of soils used for various Civil Engineering Activities**
	1. **Sieve Analysis – Classification of soil**
	2. Study the classifications of various types of soils
	3. Use apparatus required for conducting sieve analysis of soils
	4. Explain the procedure for conducting sieve analysis of soils
	5. Perform sieve analysis over a given soil sample

**Atterberg Limits of Soil**

* 1. Study the significance of Atterberg limits of soil in civil engineering activities
	2. Study Atterberg limits of soils
	3. Use apparatus required for conducting tests to determine Atterberg limits of soil
	4. Explain the procedure for conducting Atterberg limits of soil
	5. Perform tests to determine liquid limit, plastic limit, shrinkage limit and plasticity index of a given soil sample
	6. Calculate the values of Atterberg limits of given soil sample from the observations of tests
	7. Classify given soil sample based on sieve analysis and Atterberg limits

**Field Density of soil (Sand Replacement Method)**

* 1. Study the significance of field density of soil
	2. Use the apparatus required for conducting field density of soil
	3. Explain the procedure for conducting field density test on soil by sand replacement method
	4. Perform field density test of soil by sand replacement method

**Proctor Compaction Test**

* 1. Study the significance of proctor compaction test
	2. Use the apparatus required for conducting proctors compaction test
	3. Explain the procedure for conducting proctor compaction test
	4. Perform proctor compaction test over given sample of soil
	5. Compare the observations of tests conducted on different types of soils
	6. Draw the graph for proctor’s compaction test
	7. Calculate the values OMC and MDD of given soil sample from the observations of test

**KEY Competencies to be achieved by the student**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Experiment Title** |  **Competencies** | **Key Competency** |
| 1 | Specific Gravity of fine and coarse aggregate | * Take weights of empty pycnometer, pycnometer with water and pycnometer with aggregate accurately
* Record the observations accurately
* Calculate the values correctly
 | * Take weights of empty pycnometer, pycnometer with water and pycnometer with aggregate accurately
 |
| 2 | Impact value of coarse aggregate | * Prepare sample correctly
* Weigh the cup and aggregate accurately
* Count number of strokes accurately
* Weigh residue retained on 2.36 mm sieve correctly
 |  |
| 3 | Crushing value of coarse aggregate | * Prepare sample correctly
* Weigh the mould and aggregate accurately
* Apply the load at required rate and to the required period accurately
* Weigh residue retained on 2.36 mm sieve correctly
 | * Apply the load at required rate and to the required period accurately
 |
| 4 | Abrasion value of coarse aggregate | * Weigh the aggregate accurately
* Count the required number of rotations correctly
* Weigh residue retained on 1.70 mm sieve accurately
 |  |
| 5 | Flakiness Index of coarse aggregate | * Arrangement of sieves in correct order
* Weighing the aggregate passing through thickness gauge correctly
 |  |
| 6 | Elongation Index of coarse aggregate | * Arrange the sieves in correct order
* Weigh the aggregate retaining over length gauge correctly
 |  |
| 7 | Slump cone test on concrete | * Weigh the material accurately
* Apply required no.of tampings for each layer of concrete
* Measure the subsidence accurately
 | * Measure the subsidence accurately
 |
| 8 | Compaction factor test on concrete | * Weigh the material accurately
* Weigh the mould and concrete accurately
* Calculate the compactor factor correcly
 |  |
| 9 | Casting of Cement concrete cubes | * Weigh the material accurately
* Vibrate the concrete filled in moulds to the required time correctly
* Cure the demoulded cubes to the required period
 | * Weigh the material accurately
* Vibrate the concrete filled in moulds to the required time correctly
 |
| 10 | Testing of cement concrete cubes for compression | * Apply the load at required rate correctly
* Record the load at FAILURE accurately
* Calculate the compressive strength accurately
 | * Apply the load at required rate correctly
 |
| 11 | Split Tensile Strength of concrete | * Apply the load at required rate correctly
* Record the load at FAILURE accurately
* Calculate the split tensile strength accurately
 | * Apply the load at required rate correctly
* Calculate the split tensile strength accurately
 |
| 12 | Mix design of required grade of concrete | * Calculate the proportions of material correctly
* Weigh the ingredients of concrete accurately as per design calculations
 | * Calculate the proportions of material correctly
 |
| 13 | Non-destructive tests on concrete | * Applying the load at required rate as per procedure correctly
* Calculating the strength of hardened concrete from graphs accurately
 | * Applying the load at required rate as per procedure correctly
 |
| 14 | Sieve Analysis – Atterberg limits -Classification of soil | * Weigh the residue in each sieve accurately
* Determination of Liquid and Plastic Limits & P.I.
 | Observing Range of blows between 4 and 40 |
| 15 | Field Density of soil(Sand Replacement Method) | * Calibrate the apparatus correctly
* Weigh the samples accurately
* Calculate the density accurately
 | * Calibrate the apparatus correctly
* Weigh the samples accurately
 |
| 16 | Proctor Compaction Test | * Weigh the soil correctly
* Measure the water accurately
* Apply required no.of blows of compaction accurately
* Record the observations correctly
* Draw graph correctly
 | * Weigh the soil correctly
* Measure the water accurately
* Draw graph correctly
 |

**COURSE CONTENT**

1. **Tests on Road aggregate**
2. Specific Gravity of fine and coarse aggregate
3. Impact value of coarse aggregate
4. Crushing value of coarse aggregate
5. Abrasion value of coarse aggregate
6. Flakiness index of coarse aggregate
7. Elongation index of coarse aggregate
8. **Tests on concrete**
9. Workability test by Slump Cone Test
10. Workability test by Compaction factor test
11. Casting of Cement concrete cubes
12. Testing of Cement concrete cubes for compression
13. Split tensile strength of concrete
14. Design mix of concrete proportion
15. **Non-destructive tests on concrete**
16. Surface hardness test(Rebound hammer test)
17. Ultrasonic Test
18. **Tests on Soil**
19. Sieve analysis-classification of soil.
20. Liquid limit and plastic limit
21. Field density of soil (sand replacement method)
22. Proctor Compaction Test

 **REFERENCE:**

* + - 1. Concrete Technology M.S. Shetty,

 (S. Chand & Company Ltd., New Delhi)

* + - 1. Concrete Technology(5/E) M.L. Gambhir-TMH
			2. Soils Mechanics B.C. Punmia
			3. Engineering Properties of soils and their measurement Joseph E. Bowles(TMH)

# PROJECT WORK

Subject Title : Project Work

## Subject Code : C-609

Periods/Week : 07

Periods/Semester : 105

**OBJECTIVES**

***Upon completion of the course, the student shall be able to***

1.1 Identifies different works to be carried out in the Project.

1.2 Collects data relevant to the project.

1.3 Carries out Site Surveys.

1.4 Selects the most efficient method from the available choices based on preliminary investigation.

1.5 Designs the required elements of the project as per standard practices.

1.6 Prepares working drawings for the project.

1.7 Estimates the cost of project, men, materials and equipment required.

1.8 Prepares schedule of time and sequence of operations.

1.9 Prepares project report.

1.10 Prepares C.P.M. Chart.

1.11 Collects the requirements to start a Small Enterprise/Industry under Self Employment Scheme.

1.12. Collects the necessary information to procure necessary finance, site and equipment.

1.13 Prepares the chart or model for each project.

**COURSE CONTENT**

Project work is intended to provide training in the solution of field engineering problems involving Surveying, Planning, drawing plans, designing, estimating and marking out of a building/highway/irrigation/public health project. Project work will also include the preparation of the feasibility report for any one type of enterprise under self – employment schemes.

Students shall be divided into groups of five each and shall be assigned a problem that calls for application of the knowledge he/she acquired in the course and also which involves some extra study of reference materials.

**Problems**

1. Planning of a Campus.
2. Building project.
3. Industrial complex
4. Irrigation project.
5. Rural Water Supply Scheme.
6. Sanitary Engineering Scheme.
7. Bridge project.
8. Low Cost Housing Scheme.
9. Design of framed structure type building by using a software package.
10. Set up of a small enterprise under self employment scheme.

Every student should prepare a project report and submit the same for assessment. Every student puts his share to the work in all the operations of the project. The end examination in Project work shall consist of power point presentation and Viva-voce test to be assessed by a panel of examiners comprising of an External examiner, the Head of Section, and member of staff who guided the project as Internal examiner.

**Scheme of assessment**

1) Internal assessment - 20 Marks

 2) Project report & Seminar - 20 Marks

3) Power point presentation - 60 Marks (3x20)

 & Viva – Voce

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 **Total 100**

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