Design of PSC(Cast in Situ, Pre Cast Girder with cast in situ slab)Super Structure Bridge on Pile/Well Foundation

Day 1	
Time Period	**Description of Topic**
Day-01	
09.45-13.00	**Site Selection and Hydraulic calculations for bridges** ❖ Site selection for bridges ❖ Hydrology and Hydraulic Calculations ❖ HFL determination methods ❖ Determination of design discharge through various methods ❖ Span arrangement ❖ Determination of Afflux and Linear Waterway (for alluvial plain as well as for hilly terrain) ❖ Fixing of FRL and factors considered therefore ❖ Scour depth calculations for bridges ❖ Various IRC codal provisions of IRC:SP-13 ❖ Case study for hydraulic calculation and site selection
14.00-17.15	**Components of Bridge and Selection criteria** ❖ Components of a bridge for different structural arrangements ❖ Type of bridges and selection criteria ❖ Selection criteria for foundations ❖ Selection criteria for substructure and earth retaining structures ❖ Selection criteria for superstructure ❖ Selection criteria for bearings ❖ Selection criteria for expansion joints
Day-02	
09.45-13.00 + 14.00-17.15	**Types of Foundation, Geotechnical investigations** ❖ Geotechnical investigation for selecting type of foundation and founding level • Equipment for boring • In-situ tests • Collection of Soil Sample • Types of test performed on each type of sample • Bore log data and corrections required thereon • Net safe bearing capacity for clayey soil and c-ø soil • Rock coring and evaluation of properties of rock

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	• Recommendation for type of foundation and founding level • Accuracy ❖ Calculation of bearing capacity for different type of foundation • Criteria for selecting founding level for open foundation and deep foundation considering scour depth • Depth of founding level in soil, soft rock and hard rock ❖ Various IRC codal provisions of IRC:78-2014
Day-03	
09.45-13.00	**Design loads for bridges** ❖ Design loads (Dead Load, Super Imposed Load, Live Load, Wind Load, Seismic loads, earth pressure, water pressure, buoyancy force etc.) for bridges as per IRC: 6 ❖ Liquefaction of soil under seismic conditions
14.00-17.15	**Design Concepts of Long Span Bridges** ❖ Suspension Cable Bridges ❖ Cable Stayed Bridges ❖ Extra dosed Bridges ❖ Bow String Bridge ❖ Steel and Composite Bridges
Day-04	
09.45-13.00 + 14.00-17.15	**Pile, Pile Capacity and Design of Piles** ❖ Classification of piles based on • the mechanism of load transfer (i.e. end bearing & friction piles), • Materials of construction (i.e. steel and concrete piles) and • methodology of construction (i.e. driven precast, driven cast-in-situ, bored precast & bored cast-in-situ piles) ❖ Load carrying capacity of piles in granular & cohesive soil ❖ Worked out example of load carrying capacity of piles ❖ Requirements of socket length in rock ❖ Spacing of end bearing and friction piles ❖ Dimensions of the pile cap

	❖ Calculation of forces in piles ❖ Structural design of piles ❖ Structural design of pile caps ❖ Detailing of piles and pile caps ❖ Worked out example of design of Pile (Bored Cats in Situ) and Pile cap
Day-05	
09.45-13.00 + 14.00-17.15	**Design and detailing of well foundations** ❖ Shape of wells ❖ Components of a well (i.e. cutting edge, well curb, well steining, bottom plug, selected fill, intermediate/top plug & well cap) ❖ Minimum grip length ❖ Size of wells ❖ Minimum distance between adjacent wells ❖ Design of wells with respect to sub-surface soil ❖ Design and detailing of cutting edge ❖ Design and detailing for well curb ❖ Design and detailing for well steining ❖ Design requirements for bottom plug/intermediate plug/ top plug ❖ Design and detailing of well cap ❖ Worked out example of Well (Single Well and Circular Well) Foundation design and detailing
Day-06	
09.45-13.00 + 14.00-17.15	**Design and detailing of sub structures** ❖ Design and detailing of abutments ❖ Design and detailing of abutment caps ❖ Design and detailing of piers ❖ Design and detailing of pier caps ❖ Design and detailing of bearings, bearing pedestals & reaction blocks ❖ Design and detailing of return walls, dirt walls & wing walls

	❖ Worked out examples of each components of sub structure (Solid RCC embankment with Cantilever retrun wall, pier, pier cap, abutment cap,POT-PTFE bearing)
Sunday-Period for revision and assignment completion	
Day-07	
09.45-13.00 + 14.00-17.15	**Grillage analysis and design of RCC beam (demonstration by faculty)** ❖ Grillage analysis of RCC beam and slab type deck (having same concrete grades for beams and slab) ❖ Design of beams of above mentioned grillage analysis ❖ Design of deck slab ❖ Detailing of RCC beams and slab of above mentioned example
Day-08	
09.45-13.00 + 14.00-17.15	**Grillage analysis and design of RCC beam (Hands on practice by trainees)** ❖ Grillage analysis of RCC beam and slab type deck (different example, to be done by the participants) ❖ Design of beams of above mentioned grillage analysis (to be done by the participants) ❖ Design of deck slab (to be done by the participants) ❖ Detailing of RCC beams and slab (to be done by the participants)
Day-09	
09.45-13.00 + 14.00-17.15	**Basic theory of Pre-stressing, losses, design steps and anchorage system** ❖ Basic theory of pre-stressed concrete ❖ Losses of pre-stress ❖ Economical profile of pre-stressing tendon for simply supported girders, continuous girders, cantilevers, portals and sequentially cast spans ❖ Typical design steps for design of pre-stressed concrete members ❖ Advantages and limitations of pre-stressed concrete ❖ Typical cross sections of pre-stressed concrete members ❖ Forms and properties of pre-stressing tendon (i.e. wires, strands, tendon, cable & bars) ❖ Types of pre-stressing

	• Internal & external pre-stressing along with uses, comparisons, merits & limitations • Pre-tensioning & post-tensioning along with uses, comparisons, merits & limitations • Full, limited & partial pre-stressing along with their applications • Uniaxial & biaxial pre-stressing ❖ Bonded and unbonded tendons for pre-stressed concrete members ❖ Spacing and cover to pre-stressing (cable) ducts for post-tensioned concrete ❖ Spacing and cover to pre-stressing strands for pre-tensioned concrete ❖ Anchorage Block ❖ General and local anchorage zones in pre-stressed concrete ❖ Requirement of anti-burst (spiral reinforcement) around trumpet in post-tensioned concrete ❖ Use of blister and deviator blocks in pre-stressed concrete superstructure. ❖ Stages of pre-stressing
Day-10	
09.45-13.00 + 14.00-17.15	**Grillage analysis and design of Pre-stressed girders** ❖ Grillage analysis of prestressed concrete beam and slab type deck (having different concrete grades for beams and slab) ❖ Design of prestressed concrete beams of above mentioned grillage analysis ❖ Detailing of prestressed concrete beams
Day-11	
09.45-13.00 + 14.00-15.30	**Grillage analysis and design of Pre-stressed girders (to be done by the participants)** ❖ Grillage analysis of prestressed concrete beam and slab type deck (having different concrete grades for beams and slab) ❖ Design of prestressed concrete beams of above mentioned grillage analysis ❖ Detailing of prestressed concrete beams
15.45-17.15	**Test, Feedback, Concluding and Distribution of Certificates**