Course Title: BRIDGE ENGINEERING

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VIII

Subject Code	**18CV821**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks- 100**	

Course objectives: This course will enable students to understand the analysis and design of concrete Bridges.

Module -1

Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth

Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

L1,L2

Module -2

Design of Slab Bridges: Straight and skew slab bridges

L2,L3

Module -3

Design of T beam bridges(up to three girder only)

Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

L2,L3,L4

Module -4

Other Bridges:

Design of Box culvert (Single vent only)

Design of Pipe culverts

L2,L3,L4

Module -5

Substructures - Design of Piers and abutments,

Introduction to Bridge bearings, Hinges and Expansion joints.(No design)

L2,L3,L4

Course outcomes: After studying this course, students will be able to:

1. Understand the load distribution and IRC standards.
2. Design the slab and T beam bridges.
3. Design Box culvert, pipe culvert
4. Use bearings, hinges and expansion joints and
5. Design Piers and abutments.

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.

2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India

Reference Books:

5. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2., Nem Chand Brothers.
6. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
7. "Concrete Bridges", The Concrete Association of India

Course Title: PREFABRICATED STRUCTURES
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VIII

Subject Code	**18CV822**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

5. Understand modular construction, industrialised construction
6. Design prefabricated elements
7. Understand construction methods.

Module -1

Introduction: Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.

L1,L2

Module -2

Prefabricated Components: Behaviour of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels –Columns–Shear walls

L1,L2

Module -3

Design Principles: Disuniting of structures-Design of cross section based on efficiency of material used–Problems in design because of joint flexibility –Allowance for joint deformation.

L2,L3

Module -4

Joint In Structural Members: Joints for different structural connections–Dimensions and detailing–Design of expansion joints

L1,L2,L3

Module -5

Design For Abnormal Loads: Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Use modular construction, industrialised construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

4. CBRI, Building materials and components, India, 1990
5. Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

Reference Books:

- Koncz T.,"Manual of precast concrete construction", Vol.I, II and III, Bauverlag, GMBH,1976.
- "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009

Course Title: ADVANCED FOUNDATION DESIGN
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

Subject Code	**18CV823**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks-**	**100**

Course objectives: This course will enable students to

9. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course (15CV53)
10. Develop profound understanding of shallow and deep foundation analyses
11. Develop understanding of choice of foundation design parameters
12. Learn about cause and effect of dynamic loads on foundation

Module -1

General bearing capacity equation – Terzaghi's, Brinch Hansen's and Mayerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

L1,L2

Module -2

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure

L2,L3

Module -3

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

L1,L2,L3

Module -4

Well Foundations: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.

Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

L1,L2,L3

Module -5

Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

7. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.

8. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles

9. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons

10. Understand basics of analysis and design principles of machine foundations

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Punmia B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Co., India
2. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.

Reference Books:

1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India
4. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

Course Title: REHABILITATION AND RETROFITTING
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VIII

Subject Code	**18CV824**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;

- Investigate the cause of deterioration of concrete structures.
- Strategies different repair and rehabilitation of structures.
- Evaluate the performance of the materials for repair

Module -1

General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

L1,L2

Module -2

Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems

L1,L2

Module -3

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

L1,L2,L3

Module -4

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building

L1,L2,L3

Module -5

Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

6. Understand the cause of deterioration of concrete structures.
7. Able to assess the damage for different type of structures
8. Summarize the principles of repair and rehabilitation of structures
9. Recognize ideal material for different repair and retrofitting technique

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

3. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
4. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.

Reference Books:

1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).

Course Title: PAVEMENT DESIGN
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

Subject Code	**18CV825**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks-**	**100**

Course objectives: This course will enable students to

1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

Module -1

Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement

Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above

L2, L3,L4

Module -2

Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.

Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above

L5,L6

Module -3

Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflectometer, GPR method. Design factors for runway pavements, Design methods for

Airfield pavement and problems on above

L4,L5

Module -4

Stresses in Rigid Pavement : Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above

Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars,

Design factors for Runway pavements, Design methods for airfield pavements, problems of the above

L4,L5,L6

Module -5

Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of subgrade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints

L4,L5

Course outcomes: After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, burmister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky

Reference Books:

1. Yoder & wit zorac , "Principles of pavement design", John Wiley & Sons.

2. Subha Rao, "Principles of Pavement Design".

3. R Srinivasa Kumar, "Pavement Design" , University Press.

4. Relevant recent IRC codes

Course Title: INTERNSHIP /PROFESSIONAL PRACTICE
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VIII

Subject Code	**18CV185**	**IA Marks**	**40**
Number of Lecture Hours/Week	**Industry Oriented**	**Exam Marks**	**60**
Total Number of Lecture Hours	**Industry Oriented**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to get the field exposure and experience

Note: Internship /Professional Practice:

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organisations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.
2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions
3. The industry/organisation should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.
4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.
5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by

university and internship guide from the institute.

6. The College shall facilitate and monitor the student internship program.
7. The internship should be completed during vacation after VI and VII semesters.