NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech in Civil Engineering**
Course Code:	4CL102ME25
Course Title:	**Earthquake Resistant Design of Structures**
Course Type:	**Department Elective-IV**
Year of introduction:	**2025-26**

L	T	Practical Component				C
		LPW	PW	W	S	
3	1	-	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. explain parameters related to earthquakes and characteristics of earthquakes with their impact on structures (BL5)
2. develop response spectrum for estimation of central load and illustrate design spectrum (BL4)
3. analyse buildings for earthquake load (BL4)
4. apply codal provisions for the design and ductile detailing of a framed structure. (BL3)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Seismology and Strong Ground Motion** Introduction to earthquakes, causes of earthquakes, plate tectonics, seismic waves, earthquake parameters, measures of earthquake ground motion, seismic instruments and characteristics of ground motions, secondary effects of earthquake, configuration and features of earthquake vulnerability, learning from past earthquake events, earthquake resistant features,	12
Unit-II	**Response and Design Spectrum** Derivation of dynamic equilibrium equation for earthquake excitation, review of numerical methods, Response spectrum: concept, development and limitations; lateral load estimation using response spectrum, design spectrum for elastic systems	10
Unit-III	**Lateral Load Analysis of the Building** Lateral load estimation through codal provisions, response spectrum method, combination of response quantities, irregularity of building, lateral load distribution of torsionally coupled and uncoupled systems	10

Unit-IV	**Design of Structures** Lateral load resisting systems, concept of ductility, ductile detailing of framed structure using codal provisions, seismic response control techniques	13

Tutorial Work:
This shall consist of at least 04 tutorials based on the above syllabus.

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/ References:

- Paulay, T. and Priestley, M. J. N. *Seismic Design of Reinforced Concrete and Masonry Buildings*, Wiley.
- Agarwal, P. and Shrikhande, M. *Earthquake Resistant Design of Structures*, Prentice Hall of India Private Limited.
- Chopra, A.K. *Dynamics of Structures*, Pearson Education India.
- Rajasekaran S. *Structural Dynamics of Earthquake Engineering- Theory and Application using MATHEMATICA and MATLAB,* Woodhead Publishing Limited, CRC Press.
- Wakabayashi M. *Design of Earthquake-Resistant Buildings*, McGraw Hill Book Company.
- Wiegel R. L. *Earthquake Engineering*, Prentice-Hall, Inc., Englewood Cliffs, N.J.
- IS Codes: IS 1893, IS 13920, IS 456

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech in Civil Engineering**
Course Code:	4CL203ME25
Course Title:	**Advances in Construction Management**
Course Type:	**Department Elective-IV**
Year of Introduction:	**2025-26**

L	T	Practical Component				C
		LPW	PW	W	S	
3	1	-	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. justify the need for risk and personnel management (BL5)
2. apply the concept of accounting and finance in construction projects (BL3)
3. examine the use of precedence and ladder network (BL4)
4. determine the earned value of construction projects (BL5)
5. appraise the need of modern management practices in construction projects (BL5)

Unit	Contents	Teaching hours
Unit-I	**Accounting and Financial Management** Accounting Management: principles, process, revenue recognition, balance sheet, profit and loss account, working capital, ratio analysis; Finance Management: goals, functions, financial analysis, forecasting, financial decision	10
Unit-II	**Ladder & Precedence Network** Introduction, need of ladder network, precedence network analysis: finish to start, finish to finish, start to start, start to finish, line of balance concept.	06
Unit-III	**Risk Management and Insurance for Construction Projects** Risk management: identification, analysis and evaluation, response management, risks in international construction, Insurance: fundamental principle, policies for organization, project insurance, marine-cum-erection insurance, contractor's all-risk insurance, fire policy, plant and machinery insurance, liquidity damages insurance, professional indemnity policy.	05
Unit-IV	**Modern Project Management System** Lean principles in construction, Integrated project management system, use of software for managing construction projects, Building Information Modelling, Use of AI & ML in construction	15
Unit-V	**Earned Value Management** Definition, need, budgeted cost of work performed, budgeted (or planned) cost of work performed, actual cost of work performed, schedule and cost variance, cost performance Index, schedule performance index, estimate at completion, budget at completion, criteria for successful EVM, benefit of EVM	04

Unit-VI **Personnel Management** 05

Definition, rational & social system model, functions: man power planning, selection, performance evaluation, training, welfare, motivation.

Tutorial Work:
This shall consist of at least 04 tutorials based on the above syllabus.

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

- Chitkara K. K., *Construction Project Management: Planning, Scheduling and Controlling*, Tata McGraw-Hill Publishing Company Ltd.
- Jha, K.N., *Construction and Project Management*, Pearson.
- Hendrickson C., Au, T., *Project Management for Construction - Fundamental Concepts for Owners, Engineers*, Architects and Builders, Prentice Hall.
- Willis, E. M., *Scheduling Construction Projects*, John Wiley & Sons.
- Schexnayder, K., Mayo, F., *Construction Management Fundamentals*, McGraw-Hill Publishing.
- Prasanna C., Financial Management, Tata McGraw Hill.
- Highman A., Bridge C. and Farrell P., *Project Finance for Construction*, Routledge.
- Hardin B. & Mccool D., *BIM and Construction Management: Proven Tools, Methods, and Workflows*, Wiley.

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech in Civil Engineering**
Course Code:	4CL301ME25
Course Title:	**Pavement Engineering**
Course Type:	**Department Elective-IV**
Year of Introduction:	**2025-26**

L	T	Practical Component				C
		LPW	PW	W	S	
3	1	-	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. analyse the factors affecting design and performance of pavements (BL4)
2. apply concepts of flexible and rigid pavement design (BL3)
3. examine the fundamentals of pavement construction techniques (BL4)
4. evaluate pavement distress and evolve maintenance management plan (BL5)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Stresses in Flexible and Rigid Pavement** Types and functions of pavements, Traffic loading and axle configuration, Pavement design philosophy, Pavement distresses and their causes, Design traffic and serviceability criteria,	10
Unit-II	**Flexible Pavement Design** Flexible pavement components and their functions, design methods: empirical, semi-empirical, and mechanistic-empirical, Design of flexible pavements using IRC and AASHTO methods	12
Unit-III	**Rigid Pavement Design** Rigid pavement components and their functions, design methods: empirical and mechanistic-empirical, Design of jointed plain concrete pavements, continuously reinforced concrete pavements, Design of pre-stressed concrete pavements	12
Unit-IV	**Pavement Construction** Construction materials and techniques for flexible and rigid pavements, Quality control and quality assurance in flexible and rigid pavement construction, Pavement drainage and subsurface drainage systems, Subgrade preparation and stabilization for rigid pavements, introduction to composite pavements and white topping	06

Unit-V	**Pavement Maintenance and Management** Introduction to pavement maintenance and management, Pavement distress identification and rehabilitation, Pavement preservation techniques, Pavement maintenance and management systems	05

Tutorial Work:
This shall consist of at least 04 tutorials based on the above syllabus.

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

- Huang Y. H., *Pavement Analysis and Design*, Pearson Education.
- Khanna S. K., Justo C. E. J., Veeraraghavan A., *Highway Engineering*, Nem Chand and Brothers.
- Yoder E. J., and Witczak, *Principles of Pavement Design*, Wiley India.
- Kumar S, *Pavement Design*, Universities Press, Orient Black Swan.
- Chakraborty P., Das A., *Principles of Transportation Engineering*, Prentice Hall India Learning.
- Srinivasa Kumar, R., *Pavement Evaluation and Maintenance Management System*, Universities Press (India).
- MoRTH, *Specifications for Road and Bridge Works,* Indian Road Congress.
- *Manuals on Pavement Design* – IRC37, IRC58, Indian Road Congress.

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech in Civil Engineering**
Course Code:	4CL601ME25
Course Title:	**Hydraulic Structures**
Course Type:	**Department Elective-IV**
Year of Introduction:	**2025-26**

L	T	Practical Component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. classify various hydraulic structures (BL4)
2. identify forces acting, failure cause and control measures of embankment dams (BL3)
3. analyse stresses on concrete dams and check various factors of safety (BL4)
4. justify use of various types of spillways and energy dissipators for water management (BL5)
5. choose various types of falls and cross drainage works for canal regulation (BL5)

Unit	Contents	Teaching hours (Total 45)
Unit I	**Introduction to hydraulic structures** Types, components and functions, dam: classification, merits and demerits, site assessment and selection criteria. Introduction to drop structures.	04
Unit-II	**Embankment dam** Nature and characteristics of soils, principles of design, material and construction, determination of internal seepage, phreatic line, stability and stresses, failure and control measures. rockfill embankments: settlement and deformation.	10
Unit-III	**Concrete dam** Concepts and criteria for loading, stability and failure analysis, principal stresses, elementary dam profile, design, height of dam, drainage galleries, construction joints.	11
Unit IV	**Spillway and Energy Dissipators** Spillways: introduction, components, types, cavitation, features, design of ogee spillway, ancillary works. energy dissipators: types, stilling basin, plunge pool.	10
Unit V	**Drop structures** Types of falls, design principles, design of vertical drop fall, functions and types of regulators, types of cross drainage works.	10

Tutorial Work:
This shall consist of at least 04 tutorials based on the above syllabus.

Self-Study: The self-study components of the syllabus will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/ References:

- James, C. S. *Hydraulic structures*. Berlin/Heidelberg, Germany: Springer.
- Punmia, B. C., Lal, P. B. B., Jain, A. K., & Jain, A. K. *Irrigation and water power engineering*. Laxmi Publications, Ltd.
- Garg Santosh Kumar, *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers.
- Modi. P. N., *Irrigation Water Resources and Water Power Engineering*, Standard Book House.
- Arora, K.R., *Irrigation, Water Power and Water Resources Engineering*, Standard Publishers Distributors.
- Singh, B., and Varshaney, R.S., *Engineering for Embankment Dams*
- Novak, P., Moffat, A. I. B., Nalluri, C., & Narayanan, R. A. I. B. Hydraulic structures. CRC Press.
- Lindell, J. E., Moore, W. P., & King, H. W. *Handbook of hydraulics*. McGraw-Hill Education.
- Ghosh, K. M. *Analysis and Design Practice of Hydraulic Concrete Structures*. PHI Learning Pvt. Ltd.
- Asawa, G. L. Irrigation and water resources engineering. New age international.