

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAAC Accredited-2015'B'

Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

**Structure & Syllabus:
Honors Degree in Infrastructure Engineering
with
B. Tech. (Civil Engineering)**

**T.Y. B. Tech (Civil Engineering)
w. e. f. Academic Year 2022-23**



**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR
UNIVERSITY, SOLAPUR**

FACULTY OF ENGINEERING & TECHNOLOGY

Honors in Infrastructure Engineering

(With B. Tech. Civil Engineering)

WEF batch of 2020-21

Effective to S. Y. B. Tech Hons. Batch of 2021-22

Course Code	Course Name	Hrs./week			Credits	Examination Scheme			
		L	T	P		ESE	ISE	ICA	Total
Semester-IV									
Hn411	Applications of Information Technology and Information systems	3	1		4	70	30	25	125
Semester-V									
Hn512	Planning and Design of Rural Roads	3		2	4	70	30	25	125
Semester-VI									
Hn613	Roads and Highway Project Development	4		2	5	70	30	25	125
	Seminar			2*	1			50	50
Semester-VII									
Hn714	Bridge and Grade Separated Structures	3		2	4	70	30	25	125
	Mini Project			2*	1			50	50
Sub Total		13	1	10	19	280	120	200	600



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

**S.Y. B. Tech. Civil Engineering- II; Semester –
IV**

Hn- 411- Applications of Information Technology and Information Systems

Teaching Scheme

Lectures–3Hrs/Week,3Credits

Tutorial–1Hr/Week,1Credit

Examination Scheme

ISE–30Marks

ESE –70 Marks

ICA–25Marks

Course Outcomes:

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

1. Connect digital tools to construction practice and apply techniques to calculate cost of different structures.
2. Solve Linear Programming Problems, Material Transportation and Work Assignment problems using MS Office tools.
3. Learn inventory management and planning using AutoCAD software.
4. Work on Linear scheduling of Project using with optimized solutions using various software's.
5. Create models with applications of Building Information Modelling (BIM) software's.

SECTION-I

Unit 1: Introduction Overview of IT Applications in Construction (8 hours)

Construction process – Computerization in Construction applications – Computer aided 'Elementary level Cost Estimation' using functions of spreadsheet or Excel software – Developing application with database software by using MS ACCESS tools.

Unit 2: Optimization Techniques (8 hours)

Linear programming, Introduction only of Dynamic programming (No numerical to be asked in exam) and Integer Programming for two variable constraints and objective function (Graphical method or Linear Programming Problem solver tools – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications such as 'Excel Solver'.

Unit 3 Inventory Management (7 hours)

Definition and types of inventory, Economic Order Quantity (EOQ) and Always Best Control (ABC) analysis, Software applications using spreadsheet and Excel tools for Inventory Management.

SECTION-II

Unit: 4 Computer Application Advanced planning and scheduling concepts (6 hours)

Computer applications in planning using AutoCad – Scheduling using spreadsheet or Excel- Case study – Introduction to 3D Printing in construction.

Unit: 5 Automation Techniques Introduction (6 hours)

Automation in Surveying and Mapping Applications of LiDAR, drones and GPS in survey and mapping, Design automation in construction and Construction –

Automation in Highway Construction-Applications of Light Detection & ranging (LiDAR), three dimensional laser scanning, 3D design of roads, Automated Machine Guidance, Intelligent Compaction (IC), Nondestructive Testing(NDT) for Quality Assurance (QA) and Quality Control(QC), Ground Penetrating radar (GPR), Telematics, Smartphones & tablets , Tunnel and Bridge Construction-ROBINSPECT: Towards a Fully Automated Robotic Inspection System, Sonic and Ultrasonic Methods

.

Unit: 6 Application of software in Linear scheduling of Project (Introduction) (4 hours)

Project – Work Breakdown Structure (WBS) – Activity – Relationship - Scheduling – Constraints – Schedule data – Resources – Role – Optimizing Project Plan – Execution and Control – Performance

Unit: 7 Introduction to ‘Building Information Modelling’ (4hours)– Parametric modelling – Visualisation – Completion of building modelling – 4D simulation using Navis works – Navigation and Clash detection.

Unit: 8 Contemporary issues (2 hours)

Dimension of time, money, sustainability and facility management in 7D building Information System.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Internal Continuous Assessment (ICA) shall consist of minimum six assignments based on the entire curriculum

Text Books

1. Boyd C. Paulson, Computer Applications in Construction (McGraw-Hill International Editions Series)
2. Advances in Construction ICT and e-Business Edited By Srinath Perera, Bingunath Ingirige, Kirti Ruikar, Esther Obonyo Copyright Year 2017
3. Ramli, Mohd Zamri and Mesir, Baharin (2004) Civil Engineering Information System-3rd Edition. ITUCE FKA, pp 75-80
4. Sham Tickoo (2017), Autodesk Navisworks 2017, BPB Publications

Reference Books

1. Step-By-Step Optimization With Excel Solver - The Excel Statistical Master, Mark Harmon, Excel Master Series.
2. Kenneth Hess ,Access 2007, The L Line, The express line to Learning, Wiley India Pvt.Ltd.
3. Geoff Relph and Catherine Milner, Inventory Management -Advanced Methods for Managing Inventory within Business Systems, Kogan Page Limited
4. Paul E. Harris , Planning and Scheduling Using Microsoft Project 2013, Eastwood Harris Pty Ltd
5. Jay Sanjayan, Ali Nazari, Behzad Nematollahi, 3D Concrete Printing Technology: Construction and Building Applications, Elsevier - Health Sciences Division
6. Paul E. Harris, Planning and Control Using Microsoft Project and PMBOK Guide, Eastwood Harris Pty Ltd
7. Edited by Carlos Balaguer and Mahamed Abderrahim, Robotics and Automation in Construction, InTechOpen publication
8. Edited by Petros A. Ioannou, Automated Highway Systems, Plenum Press New York
9. Vinayagam P., VimalaA., (2017), "Planning and Managing Projects with PRIMAVERA (P6) Project Planner" I K International Publishing, New Delhi

10. Andrew P.Sage (2002). Information Technology and Civil Engineering in 21st Century. ASCE Talk, November 2002
11. Ahmad, Yusof (2004). STAAD.Pro Version 2003 Training Notes- First Edition. Faculty of Civil Engineering, UTM, April 2004, pp 1-2
12. Robert E. Johnson and Mark J. Clayton (1998), The Impact of Information Technology in Design & Construction: The Owner's Perspective. Automation in Construction 8, pp 3-14



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

T. Y. B. Tech. (Civil Engineering) – I, Semester- V

Hn512: Planning and Design of Rural Roads

Teaching Scheme

Lectures – 3 Hrs/Week, 3 Credits

Practical – 2 Hr/Week, 1 Credit

Examination Scheme

ISE – 30 Marks

ESE –70 Marks

ICA – 25 Marks

Course outcomes:

On completion of the course, the students will be:

1. Able to elaborate significance of low-cost roads.
2. Capable of analysing the problem associated with planning of low volume roads, preparing master plan of rural road network.
3. Capable of conducting surveys for rural road alignment and remembering specifications of various geometric features of road.
4. Capable of selecting and analysing different materials and equipment's required for rural road construction.
5. Able to design various drainage structures and cross drainage works giving due importance to maintenance activities.

SECTION-I

Unit 1: Planning of rural road: (7 Hrs)

Planning data base, concept of network planning Rural roads plan, guidelines laid down in recent 20-year plans and in PMGSY Road alignment and surveys, governing factors for route selection Factors controlling alignment; obligatory points, traffic, geometric designs, economy, special considerations in hilly areas.

Unit: 2 Geometric design standards: (7 Hrs)

Classification of rural roads, terrain classification, design speed, basic principles of geometric design cross sectional elements, camber, sight distances. Horizontal alignment: general guidelines, super elevation, transition curve, widening and set back distances, vertical

alignment: gradient, grade compensation at curves, valley curves, alignment compatibility, lateral and vertical clearances.

Unit 3: Soil and material surveys: (8 Hrs)

Soil investigations for low embankment, high embankment, cut sections, subgrade, Survey for marginal materials and aggregates/ low grade materials Artificial aggregates, waste materials, new materials and stabilizers Design parameters, pavement components Design of flexible pavement as per IRC: pavement thickness, pavement surfacing Design of semi rigid pavement: dry lean concrete / lime fly ash concrete bases Design of rigid pavement: cement concrete pavement Design of special pavements: concrete block pavement , interlocking concrete block pavement Choice of pavement type and materials

SECTION-II

Unit 4: Types of road drainage: (7 Hrs)

Requirements of surface drain; road side drains, shoulder drains, catch water drains. Requirements subsurface drain. Cross drains; types, requirements, choice of different types of cross drains. Standard designs of culverts. Standard design of small bridges.

Unit 5: Construction and Specification: (8 Hrs)

Construction and Specifications :Earth, Sub-base, Base course and surface course – materials , specifications , and construction steps and use of different equipment , construction of special pavements , construction of fly ash embankments ,lime fly ash stabilized soil, lime fly ash bound macadam , lime fly ash concrete ,roller compacted concrete , dry lean fly ash concrete , cement stabilized fly ash , quality control in construction , Specifications and tests for quality control as per IRC .

Unit 6: Maintenance of Rural roads: (8 Hrs)

Types of maintenance, maintenance of unpaved roads, maintenance of paved roads, maintenance of semi-rigid and roller compacted concrete pavements, maintenance of special pavements, Rehabilitation.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Internal Continuous Assessment (ICA) shall consist of minimum six assignments based on the entire curriculum

Text Books:

1. Khanna, S.K., Justo, C.E.G., and Veeraragavan, A., 'Highway Materials and Pavement Testing', Nem Chand and Bros, Roorkee Reference Books:
2. IRC SP 20 Rural Roads Manual
3. Ministry of Rural Road Development

Reference Books:

1. Principles of Transportation Engineering, Partha Chakroborty and Animesh Das, PHI Publication.
2. Transportation Engineering – An Introduction, Khistry, C.J., PHI Publication.
3. Specifications of Road and Bridge Works (MoRTH) Publication – 5th Revision. New Delhi.
4. IRC: 37-2018, IRC: 58-2015 and other relevant IRC codes



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
T. Y. B. Tech. (Civil Engineering) – II, Semester- VI

Hn613: Roads and Highway Project Development

Teaching Scheme

Lectures – 4 Hrs/Week, 4 Credits

Practical – 2 Hr/Week, 1 Credit

Examination Scheme

ISE – 30 Marks

ESE –70 Marks

ICA – 25 Marks

Course outcomes:

After studying this course, students will be able to:

1. Prepare project report for new and up-gradation type road works by conducting necessary feasibility/detailed studies.
2. Conduct the soil and material investigations to understand their behaviour and performance.
3. Analyze the surveys and investigations and select geometry of road
4. Understand the contract document, evaluation and contract management for road projects
Analyze the social impact of road projects and also determine the economic feasibility analysis for justification of investments.
5. Understand constructions of non-bituminous, bituminous & cement concrete pavements for flexible & rigid pavements
6. Prepare DPR on road projects with relevant drawings and get the knowledge of tendering process for the construction.

SECTION-I

Unit 1: Introduction (10 Hrs):

Various steps of preparation and execution of road projects, Investigations for preparation of project reports for new and up-gradation of roads. Objects and scope of pre – feasibility, feasibility and detailed studies for project preparation. Typical HR structure for preparations and implementation of road projects, Key Acts related to Road Projects. Salient features of ongoing road projects in India.

Unit 2: Topographic surveys and investigations: (10 Hours)

Topographic surveys and investigations for finalization of horizontal alignment and vertical profile of roads, Application of GIS. Soil and other Material surveys and investigations for availability and choice of basic and alternate materials for road construction and for soil stabilization. Cross drainage structures and drainage surveys, Interpretation of survey results. Traffic Surveys and Traffic forecasting: classified traffic volume, growth rate, projected traffic for assessing road way requirements, origin- destination characteristics and studies, Axle load / wheel load studies using weigh bridges and analysis of data for pavement design

Unit 3: Geometric Design and General elements: (10 Hours)

Geometrical elements of rural and urban roads – Cross sectional elements, horizontal and vertical alignment, Intersections-requirements, capacity of roads, road way facilities: Pedestrian facilities, bus bays, truck lay bays, traffic, medical and vehicle aid posts, street lighting, road safety audit, road safety furniture, Mx ROAD.

SECTION-II

Unit 4: Environmental Impact Assessment: (10 Hours)

Objectives, procedure of environmental impact assessment, socio economic survey, mitigation measures, Landscaping and tree plantation, implementation of environment management plan, Key environmental legislations, clearances required for road project-environmental, forest, CRZ, wild life, air, noise quality standards.

Module 5: Preparation of DPR Design Details: (10 Hours)

Estimates, BOQ, drawings and detailed project report, use of software Tendering process - Preparation of tender documents for different types of road projects, tender evaluation. Salient clauses of tender document, tender evaluation – technical and financial.

Unit 6: Construction of Bituminous Road & Concrete Road: (10 Hours)

Subgrade, Subbase, Base, Shoulders and Drain: Roadway and Drain Excavation, Excavation and Blasting, Embankment Construction, Construction of Gravel Base, Cement Stabilised Sub- Bases, WBM Bases, Wet Mix Construction; Preparation and Laying of Tack Coat; Bituminous Macadam, Penetration Macadam, Built up Spray Grout, Open Graded Premix, Mix Seal, Semi-Dense Asphalt Concrete-Interface Treatments and Overlay Construction,

IRC Specifications. Cement Concrete Pavement Analysis - Construction of Cement Roads, Manual and Mechanical Methods, Joints in Concrete and Reinforced Concrete Pavement and Overlay Construction.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

- 1) Internal Continuous Assessment (ICA) shall consist of minimum six assignments based on the entire curriculum.
- 2) Field visits to the nearest bituminous road, concrete road, RMC plant, Hot Mix Plant and Pug Mill Plant. The field report shall be submitted based on the site visits.
- 3) Production of Plan, Longitudinal section, cross section and calculation of cutting and filling quantities using latest road geometrical design software.

TEXT BOOKS

1. Dr. L.R.Kadyali, Dr. N.B.Lal, "Principles and Practices of Highway Engineering,, Khanna Publishers
2. K.K. Chitkara. "Construction Project Management Planning, Scheduling and Controlling"- Tata McGraw Hill publications
3. S.C. Sharma "Construction Equipment and its Management"- Khanna Publishers

REFERENCE BOOKS

1. IRC: SP:19 - 2001, Manual for Survey, "Investigation and Preparation of Road Projects"- (first revision), Indian Roads Congress
2. IRC: SP: 30 - 1993, "Manual on Economic Evaluation of Highway"- Projects in India (first revision), Indian Roads Congress
3. IRC SP – 38,"Manual for Road Investment Decision Model"-1992, Indian Roads Congress
4. IRC : 9-1972, 35 – 1997,38-1988, 39-1986, 52-2001, 54-974, 62-1976, 64-1990, 66-1976, 67-2001, 69-1977, 73-1980, 79-1981, 80-1981, 86-1983, 98-1997, 99-1988, 103-1988, 104-1988, 110-1996
5. MoRTH "Specifications for Road Bridge Works"- 2001, fourth revision, Indian Roads Congress
6. MoRTH "Standard and Bidding Document Procurement of Civil Works"- Part I and II, 2000, Indian Roads Congress MoRTH "Model Concession Agreement for Small Road Projects"-2000, Indian Roads Congress



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
T. Y. B. Tech. (Civil Engineering) – II, Semester- VI

Seminar

Teaching Scheme

Practical – 2 Hr/Week, 1 Credit

Examination Scheme

ICA – 50 Marks

Seminar shall be delivered on one of the advanced topics chosen in consultation with the supervisor after compiling the information from the latest literature. The concepts must be clearly understood and presented by the student. All modern methods of presentation should be used by the student. Minimum 03 presentations are expected within period of semester by the student. A hard copy of the report (20 to 25 pages, A4 size, 12 fonts, Times New Roman, 1.5 line spacing with normal margin on all sides, both sides printed, as per format) should be submitted to the Department of Civil Engineering before delivering the seminar. A copy of the report in soft form must be submitted to the Supervisor along with other details, if any.

Each student should select a Seminar topic must be related to one of the following:

1. Infrastructural Engineering
2. Recent trends in Civil Engineering



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B. Tech. Civil Engg- I; Semester – VII

Hn- 714- Bridge and Grade Separated Structures

Teaching Scheme

Lectures – 3 Hrs/Week, 3 Credits

Practical – 2 Hr/Week, 1 Credit

Examination Scheme

ISE – 30 Marks

ESE –70 Marks

ICA – 25 Marks

Course outcomes:

After studying this course, students will be able to:

1. Identify the suitable techniques to construct the structure based on site condition
2. Prepare the work schedule for any type of super structure construction.
3. Identify the techniques to implement in construction of Embankment, Retaining wall, breast wall in hill road.
4. Identify the suitable method and equipment to construct a Road, Dams, Harbour, River work and pipelines.
5. Prepare a suitable plan for erection of new plants like Batching and mixing plant, Ready mix concrete plant at site.
6. Manage and maintain the equipment and its cost control.

SECTION-I

Unit1: Introduction to Bridges (8 Hours)

Basic Elements of a Bridge. Types of bridges and grade separated structures for highways, standard specifications for road bridges and grade separated structures to fulfil traffic and Structural and Hydraulic design requirements.

Unit 2: Sub Structure Construction (7 hours)

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunnelling techniques – Piling techniques -Dewatering and stand by Plant equipment for underground open excavation.

Unit 3: Superstructure Construction (7 hours)

Launching girders, bridge decks, offshore platforms – Material handling - erecting lightweight components on tall structures - Erection of articulated structures - Fabrication and erection of steel trusses and frames. Bridge testing for safe carrying capacity, strengthening of bridges, aesthetical treatments. Bridge bearings, joints, approaches, construction and maintenance aspects.

SECTION-II

Unit 4: Construction of Embankment & Retaining Wall (8 hours)

Embankment Construction - Ground improvement techniques, Retaining and Breast walls on hill road, wing walls and approaches and cofferdams.

Unit 5: Equipment Management (7 Hours)

Factors affecting selection of equipment and methods –Planning - Equipment Management in Projects - Maintenance Management – Replacement - Cost Control of Equipment – Depreciation Analysis, Methods of calculation of depreciation- Safety Management.

Unit 6: Time planning – project work breakdown: (8 Hours)

Time planning – project work breakdown determining activities involved, assessment of duration, CPM / PERT network analysis, work scheduling, methods of work scheduling, factors affecting work scheduling, Problems. Planning Control System – resource production, project cost, project time, codification and project management, information system, use of software

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Internal Continuous Assessment (ICA) shall consist of minimum six assignments based on the entire curriculum

Text Books:

1. D.Johnson Victor, “Essentials of bridge Engineering”- Oxford, IBH publishing company.
2. Ponnuswamy, “Bridge Engineering”-McGraw Hill Publication, 1989.
3. K.K. Chitkara. “Construction Project Management Planning, Scheduling and Controlling”- Tata McGraw Hill publications
4. S.C. Sharma “Construction Equipment and its Management”- Khanna Publishers

Reference Books:

- 1.Vazirani Ratwani & M. G. Aswani, “Design of Concrete Bridges”- Khanna Publishers, New Delhi
2. “Design of Bridges”- Dr. Krishna Raju, Oxford & IBH Publishing company Limited. 5. “Analysis and design of Bridges”- M. A. Jayaram, Sapna Publishers, Bangalore.
3. Peurifoy, R.L., and Clifford,JS “Construction Planning Equipment and Method”- McGraw Hill Book Co. Inc 3. Relevant IRC & ASTM Standard



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B. Tech. Civil Engg- I; Semester – VII

Mini Project

Teaching Scheme

Practical – 2 Hr/Week, 1 Credit

Examination Scheme

ICA – 50 Marks

Mini project shall be based on one of the topics chosen in consultation with the supervisor. Mini project may be on Infrastructural Engineering. Areas of recent techno-management development shall be explored. Research innovations may be considered as prospective areas. Mini project may be related with main project to explore possibilities of continuation further and to study the pre-requisites.