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Final Year Degree Course In
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HIGHWAY, BRIDGE, AIRPORT ENGINEERING



**D. R. PHATAK
H. K. GITE**

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PRAKASHAN
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A TEXT BOOK OF

TRANSPORTATION ENGINEERING

FOR
SEMESTER – I

FINAL YEAR (B.E.) DEGREE COURSE IN
CIVIL ENGINEERING

As Per the New Revised Syllabus of
Savitribai Phule Pune University
(2012 Pattern)

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PREFACE

It gives us great pleasure in presenting the book on "**Transportation Engineering**", which is written as per Savitribai Phule Pune University's revised syllabus (2012 course) and in most concised form. The book will also be very useful for the students preparing for Engineering Service Examination and AMIE Examination.

The subject matter is presented in simple and easy form. Sufficient care is taken to present the subject matter in the point wise form in most of the chapters.

Authors are extremely grateful to **Shri P. R. Bhamare**, Executive Director, MERI Nashik, **Shri Vijay Pandare**, Chief Engineer, META Nashik, **Dr. Belsare Sanjay**, Deputy Secretary and Superintending Engineer, WRD Mantralaya, Mumabi, **Shri I. S. Chaudhari**, Superintending Engineer, CDO Nashik, **Shri S. M. Sangle**, Executive Engineer, PH-Division 4, CDO Nashik, **Dr. P. P. Vitkar**, Director JSPM's Pune, **Shri S. L. Bhilare**, Associate Professor Civil Engineering Department RSCOE, Pune, and the entire staff of **CDO, Power House Circle, Nashik** for providing conducive environment and facilities for completing this book.

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Also, it is important to mention invaluable moral support of our beloved family members, who consistently encouraged us for better work.

Despite the best efforts taken by authors, it is possible that some unintentional errors might have taken place. Authors would gratefully acknowledge if any of these are pointed out. Suggestions and comments for further improvement of this book will be gratefully received and acknowledged from the students, teachers and others.

Pune

Authors

SYLLABUS

Unit I: Highway Engineering

(6 hrs)

Introduction:

Role of transportation, scope of road transportation, highway development in India, necessity of highway planning and development plans e.g. Bombay plan, Lucknow plan.

Classification of road:

Classification of roads, road patterns, planning surveys and preparation of master plan based on saturation system, determination of road length by 3rd road development plan.

Traffic engineering:

Traffic characteristics-road user characteristics, vehicular characteristics (only name and significance) Traffic studies –name of various studies and their uses, accident studies-objectives, causes of accident, condition and collision diagram, and measures for the reduction in accidents. Traffic regulation and control devices-traffic signs, traffic signals (types merits and demerits) road markings. Traffic islands, types of road intersections (sketch merits and demerits). Parking facilities.

Unit II

(6 hrs)

Highway alignment:

Basic requirements of an ideal alignment and factors controlling it, engineering survey for highway location, special requirements for hill roads,

Geometric design and traffic engineering:

Design controls and criteria for geometric design, cross sectional elements, sight distance requirements, stopping distance, overtaking sight distance, overtaking zones with IRC recommendations, attainment of super elevation, radius of curves, methods of introduction of extra widening, widening of pavement on horizontal curves, horizontal transition curves- objects, necessity, types of transition curves, length and shift of transition curves. Design of vertical alignment, gradient and its type, IRC recommendations, grade compensation on horizontal curve, vertical curves: - crest and sag curves, types of summit curves, length of summit curve for SSD and OSD. Requirements, types of valley curves, length of valley curve for comfort and head light sight distance criteria.

Highway drainage:

Importance of highway drainage, subsurface and surface drainage systems, scope of arboriculture for highway.

Unit III

(6 hrs)

Highway materials:

Importance and properties of sub-grade, pavement component materials. Tests on aggregates. Bitumen: Types--cut back, tar, emulsion and tests, modified binders, bitumen mix design by Marshall Stability test, viscosity based gradation of bitumen

Pavement design:

Objects and requirements, types of pavements structures, functions of pavement components factors affecting pavement design, Design of flexible pavement by C.B.R. Method, IRC 37-guidelines design of rigid pavements, actors affecting design & analysis of stress- wheel load stress & temp. Stress, critical combination of stress, IRC 58- design guidelines, types of joints, requirements of joints.

Construction:

Construction process of WBM, WMM, GSB (Mix design). Introduction to bituminous works such as prime coat, tack coat, seal coat, MPM, AC or BC, BM, DBM and premix carpet.

Unit IV: Airport Engineering**(6 hrs)****Introduction:**

Advantages and limitations of air transportation. Aeroplane component parts and important technical terms.

Airport planning:

Aircraft characteristics, which influence judicious and scientific planning of airports, Selection of sites, survey and drawings to be prepared for airport planning.

Airport layout:

Characteristics of good layout, runway configuration, airport obstruction, location of terminal buildings, aprons and hangers. Zoning requirements regarding permissible heights of constructions and landing within the airport boundary.

Runways and taxiways:

Runway orientation, wind coverage, use of wind rose diagram, basic runway length, corrections for elevation, temperature and gradient as per ICAO and FAA recommendation. Airport classification by ICAO.

Unit V: Bridge Engineering**(6 hrs)****Introduction:**

Classification of bridges, components of bridges, preliminary data to be collected during investigation of site for bridges, determination of discharge – empirical formula, direct methods, economical span, afflux, HFL, scour depth and clearance, locations of piers and abutments, factors influencing the choice of bridge super structure, approach roads.

Loads on bridges:

Brief specifications of different loads, forces, stresses coming on bridges, IRC load specification, requirements of traffic in the design of highway bridges

Substructure:

Abutment, Piers, and wing walls with their types based on requirement and suitability.

Unit VI**(6 hrs)****Types of bridges****Various types of bridges:**

- a. Culvert: Definition, waterway of culvert and types.
- b. Temporary bridges: Definition, materials used brief general ideas about timber, floating and pantoon bridges.
- c. Movable Bridges: Bascule, cut boat, flying, swing, lift, transporter and transverse bridges, their requirement and suitability.
- d. Fixed span bridges:
Simple, continuous, cantilever, arch, suspension, bowstring girder type and rigid frame and cable stayed bridges, materials for super structure.

Bearing:

Definition, purpose and importance. Types of bearings with their suitability.

Erection of bridge super structure and maintenance:

Introduction to different techniques of erection of bridge super structure and maintenance of bridges.

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