

**STATE BOARD OF TECHNICAL EDUCATION, BIHAR**

Scheme of Teaching and Examinations for

**IV Semester Diploma in Civil Engineering / Civil (Rural) Engineering**

( Effective from Session 2016-17 Batch )

**THEORY**

Sr. No.	SUBJECT	SUBJECT CODE	TEACHING SCHEME	EXAMINATION-SCHEME							
			Periods per Week	Hours of Exam.	Teacher's Assessment (TA) Marks A	Class Test (CT) Marks B	End Semester Exam.(ESE) Marks C	Total Marks (A+B+C)	Pass Marks ESE	Pass Marks in the Subject	Credits
1.	Advance Surveying	1615401	02	03	10	20	70	100	28	40	02
2.	Mechanics of Structures	1615402	03	03	10	20	70	100	28	40	03
3.	Geo Technical Engineering	1615403	03	03	10	20	70	100	28	40	03
4.	Transportation Engineering	1615404	03	03	10	20	70	100	28	40	03
5.	Hydraulics	1615405	03	03	10	20	70	100	28	40	03
Total :-			<b>14</b>				<b>350</b>	<b>500</b>			

**PRACTICAL**

Sr. No.	SUBJECT	SUBJECT CODE	TEACHING SCHEME	EXAMINATION-SCHEME					
			Periods per Week	Hours of Exam.	Practical (ESE)		Total Marks (A+B)	Pass Marks in the Subject	Credits
					Internal(A)	External(B)			
6.	Advance Surveying Lab	1615406	04	03	15	35	50	20	02
7.	Mechanics of Structures Lab	1615407	03	03	15	35	50	20	01
8.	Geo Technical Engineering Lab	1615408	02	03	15	35	50	20	01
9.	Hydraulics Lab	1615409	04	03	15	35	50	20	02
Total :-			<b>13</b>				<b>200</b>		

**TERM WORK**

Sr. No.	SUBJECT	SUBJECT CODE	TEACHING SCHEME	EXAMINATION-SCHEME					
			Periods per Week	Marks of Internal Examiner (X)	Marks of External Examiner (Y)	Total Marks (X+Y)	Pass Marks in the Subject	Credits	
10.	Professional Practices-IV (TW)	1625410	03	07	18	25	10	02	
11.	Computer Aided Drawing (TW)	1615411	03	07	18	25	10	02	
Total :-			<b>06</b>			<b>50</b>			
Total Periods per week Each of duration One Hour				<b>33</b>	Total Marks =			<b>750</b>	<b>24</b>

**ADVANCE SURVEYING**  
**(CIVIL ENGINEERING GROUP)**

<b>Subject Code</b> <b>1615401</b>	<b>Theory</b>						<b>Credits</b> <b>02</b>
	<b>No. of Periods Per Week</b>						
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>100</b>	
	<b>02</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>	
	<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>	<b>:</b>	<b>20</b>	

**CONTENTS : THEORY**

<b>Name of the Topic</b>		<b>Hrs/week</b>	<b>Marks</b>
<b>Unit -1</b>	<p><b>Plane Table Survey</b></p> <p>1.1 Principles of plane table survey. Accessories required</p> <p>1.2 Setting out of plane table , Levelling , Centering and orientation.</p> <p>1.3 Methods of plane table surveying – Radiation, Intersection, and Traversing.</p> <p>1.4 Merits and Demerits of plane table Surveying. situations where plane table survey is used.</p> <p>1.5 Use of Telescopic Alidade.</p>	<b>05</b>	<b>10</b>
<b>Unit -2</b>	<p><b>Theodolite Survey</b></p> <p>2.1 Components of Transit Theodolite and Their functions. Technical terms used. Temporary adjustments of Transit Theodolite. Swinging the telescope, Transiting, Changing the face.</p> <p>2.2 Measurement of Horizontal angle, method of Repetition, errors eliminated by method of repetition.</p> <p>2.3 Measurement of Deflection angle.</p> <p>2.4 Measurement of Vertical angle.</p> <p>2.5 Measurement of magnetic bearing of a line by Theodolite .</p> <p>2.6 Prolonging a Straight line.</p> <p>2.7 Sources of errors in Theodolite Surveying.</p> <p>2.8 Permanent adjustment of transit Theodolite ( only relationship of different axes of Theodolite.).</p> <p>2.9 Traversing with Theodolite – Method of included angles, locating details, checks in closed traverse, Calculation of bearings from angles.</p> <p>2.10 Traverse Computation - Latitude, Departure Consecutive Co-ordinates error of Closure, Distribution of a angular error, balancing the traverse by Bowditch rule and Transit Rule, Gale’s traverse table .simple problems on above topic.</p>	<b>10</b>	<b>20</b>
<b>Unit - 3</b>	<p><b>Tacheometric Survey</b></p> <p>3.1 Principle of Tacheometry.</p> <p>3.2 Essential requirements of Tachometer.</p> <p>3.3 Use of Theodolite as a Tacheometer with staff held in vertical and fixed hair method (No derivation).</p> <p>3.4 Determination of tacheometric constants, simple numerical problems on above topics.</p>	<b>06</b>	<b>12</b>

<b>Unit - 4</b>	<b>Curves</b> 4.1 Types of curves used in road and railway alignments. Notations of simple circular curve. Designation of curve by radius and degree of curves. 4.2 Method of Setting out curve by offset from Long chord method and Rankine's method of deflection angles.Simple Numerical problems on above topics.	<b>05</b>	<b>10</b>
<b>Unit - 5</b>	<b>Advanced Survey Equipments</b> 5.1 Construction and use of one second Micro Optic Theodolite, Electronic Digital Theodolite. Features of Electronic Theodolite 5.2 Principle of E.D.M, Components of E.D.M and their functions, use of E.D.M. 5.3 Total station	<b>12</b>	<b>12</b>
<b>Unit - 6</b>	<b>Aerial Survey and Remote sensing</b> 6.1 Aerial Survey Introductions, definition, Aerial photograph. 6.2 Remote Sensing - Introduction, Electro-Magnetic Energy , Remote sensing system- Passive system , Active system. Applications - mineral, land use / Land cover, Natural Hazards and Environmental engineering system.	<b>04</b>	<b>06</b>
	<b>Total</b>	<b>42</b>	<b>70</b>

<b>Text /Reference Books:-</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Surveying and Levelling	<b>N N Basak</b>	<b>Tata Mc Graw-Hill</b>
Surveying and Levelling Part I and II	<b>T .P. Kanetkar &amp; S. V, Kulkarni</b>	<b>PUNE VIDHYARTHI GRIHA Prakashan</b>
Surveying and Levelling Vol. I and II	<b>Dr. B. C. Punmiya</b>	<b>Laxmi Publication</b>
Text book of Surveying	<b>S.K.Husain, M.S. Nagaraj</b>	<b>S. Chand and company</b>
Surveying and Levelling Vol. I and II	<b>S. K. Duggal</b>	<b>TATA MC GRAW-HILL</b>
Plane Surveying	<b>A.M.Chandra</b>	<b>NEW AGE INTERNATIONAL</b>
Advance Surveying	Nishit Sinha	Foundation Publishing

**MECHANICS OF STRUCTURES**  
**(CIVIL ENGINEERING GROUP)**

<b>Subject Code</b> <b>1615402</b>	<b>Theory</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>	<b>03</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>	
<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>	<b>:</b>	<b>20</b>		

**Contents : Theory**

<b>Name of the Topic</b>	<b>Hrs/week</b>	<b>Marks</b>
<b>Unit -1</b> <b>Stress &amp; Strain</b> 1.1 Definition of rigid body, plastic body, mechanical properties of metal such as elasticity & elastic limit. 1.2 Definition of stress, strain, modulus of elasticity, S. I. Unit. Classification of stress, strain, Sign convention. Stress, strain curve for mild steel and HYSD bar , yield stress/ proof stress, Ultimate stress, breaking stress and percentage elongation. 1.3 Deformation of body due to axial load. Deformation of a Body subjected to axial forces. Deformation of body of stepped c/s due to axial load, max. stress and min. stress induced. Stresses in bars of composite section & deformation. 1.4 Shear stress, shear strain & modulus of rigidity, complementary shear stress, state of simple shear, punching shear.	<b>10</b>	<b>10</b>
<b>Unit -2</b> <b><u>Elastic Constants &amp; Principal Stresses</u></b> 2.1 Definition of lateral strain, Poisson's ratio, Change in lateral dimensions 2.2 Volumetric strain due to uni-axial force and change in volume 2.3 Biaxial and tri-axial stresses and volumetric strain & change in volume 2.4 Definition of bulk modulus, volumetric strain. 2.5 Relation between modulus of elasticity, modulus of rigidity and bulk modulus. 2.6 Definition of principal planes & principal stresses 2.7 Principal planes & stress due to bi-axial stress system & due to state of simple shear. (Analytical method only)	<b>08</b>	<b>10</b>
<b>Unit - 3</b> <b>Shear Force And Bending Moment :</b> 3.1 Types of beams - cantilever, simply supported, fixed and continuous beams, types of loading- point load, uniformly distributed load, support reactions for determinate structures 3.2 Concept of shear force and bending moment, sign convention. Relation between bending moment, shear force and rate of loading 3.3 Shear force and bending moment diagrams for simply supported beams, overhanging beams and cantilever subjected to point loads, UDL and couples, point of contra flexure	<b>08</b>	<b>14</b>
<b>Unit - 4</b> <b>Moment Of Inertia:</b> 4.1 Concept of moment of inertia M.I of plane areas such as rectangle, triangle, circle, semicircle and quarter circle 4.2 Parallel axis and perpendicular axis theorem M.I of composite sections, built up sections, symmetrical and unsymmetrical sections, radius of gyration & polar moment of inertia.	<b>06</b>	<b>10</b>

<b>Unit - 5</b>	<b>Stresses In Beams:</b> 5.1 Bending Stresses in Beams: Concept of pure bending, theory of simple bending, assumptions in theory of bending, neutral axis, bending stresses and their nature, bending stress distribution diagram, moment of resistance. 5.2 Application of theory of bending to symmetrical and unsymmetrical sections. 5.3 Shear stresses in beams: Shear stress equation, meaning of terms in equation, shear stress distribution for rectangular, hollow rectangular, circular sections and hollow circular sections 5.4 Relation between max. shear stress and average shear stress.	<b>06</b>	<b>10</b>
<b>Unit - 6</b>	<b>Analysis Of Trusses</b> 6.1 Definition frames, classification of frames, perfect, imperfect, redundant and deficient frame, relation between members and joints, assumption in analysis. Method of joint, method of section and graphical method to find nature of forces.	<b>06</b>	<b>10</b>
<b>Unit - 7</b>	<b>Strain Energy</b> 7.1 Types of loading – gradual, suddenly applied load & Impact load 7.2 Definition of strain energy, modulus of resilience and proof resilience. 7.3 Comparison of stresses due to gradual load, sudden load and impact load.	<b>04</b>	<b>06</b>
	<b>Total</b>	<b>48</b>	<b>70</b>

<b>Text /Reference Books:-</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Strength of Materials	F. L. Singer	Harper& Row Publishers
Strength of Materials	R. S. Khurmi	S. Chand & Company Delhi
Mechanics of Structures volume –I & II	S. B. Junnarkar	Charotar Publishing House, Anand.
Mechanics of Structures	Aakash Verma	Foundation Publishing

**GEO-TECHNICAL ENGINEERING**  
**(CIVIL ENGINEERING GROUP)**

<b>Subject Code</b> <b>1615403</b>	<b>Theory</b>					<b>Credits</b> <b>03</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			<b>:</b>	<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>			<b>:</b>	<b>70</b>
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>			<b>:</b>	<b>10</b>
	<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>			<b>:</b>	<b>20</b>

**Contents : Theory**

<b>Name of the Topic</b>		<b>Hrs/week</b>	<b>Marks</b>
<b>Unit -1</b>	<p><b>Overview Geotechnical Engineering</b></p> <p>1.1 IS definition of soil</p> <p>1.2 Importance of soil in Civil Engineering as construction material in Civil Engineering Structures, as foundation bed for structures</p> <p>1.3 Field application of geotechnical engineering foundation design, pavement design, design of earth retaining structures, design of earthen dams (brief ideas only)</p>	<b>02</b>	<b>02</b>
<b>Unit -2</b>	<p><b>Physical Properties of Soil</b></p> <p>2.1 Soil as a three phase system</p> <p>2.2 Water content, Determination of water content by oven drying method as per IS code</p> <p>2.3 Void ratio, porosity and degree of saturation, density index</p> <p>2.4 Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight</p> <p>2.5 Determination of bulk unit weight and dry unit weight by core cutter method and sand replacement method as per IS code</p> <p>2.6 Specific gravity, determination of specific gravity by pycnometer.</p> <p>2.7 Consistency of soil, stages of consistency, Atterberg's limits of consistency viz. Liquid limit, plastic limit and shrinkage limit, plasticity index.</p> <p>2.8 Determination of liquid limit, plastic limit and shrinkage limit as per IS code.</p> <p>2.9 Particle size distribution, mechanical sieve analysis as per IS code particle size distribution curve, effective diameter of soil, Uniformity coefficient and coefficient of curvature, well graded and uniformly graded soils.</p> <p>2.10 Particle size classification of soils &amp; IS classification of soil</p>	<b>08</b>	<b>20</b>
<b>Unit - 3</b>	<p><b>Permeability of Soil &amp; Seepage Analysis</b></p> <p>3.1 Definition of permeability</p> <p>3.2 Darcy's law of permeability, coefficient of permeability, typical values of coefficient of permeability for different soil</p> <p>3.3 Factors affecting permeability</p> <p>3.4 Determination of coefficient of permeability by constant head and falling head permeability tests, simple problems to determine coefficient of permeability.</p> <p>3.5 Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines and equipotential lines.</p> <p>3.6 Flow net, characteristics of flow net, application of flow net (no numerical problems)</p>	<b>04</b>	<b>10</b>

<b>Unit - 4</b>	<b>Shear Strength of Soil</b> 4.1 Shear failure of soil, field situation of shear failure 4.2 Concept of shear strength of soil 4.3 Components of shearing resistance of soil – cohesion, internal friction 4.4 Mohr-coulomb failure theory, Strength envelope, strength equation 4.5 Purely cohesive and cohesion less soils 4.6 Laboratory determination of shear strength of soil – Direct shear test, Unconfined compression test & vane shear test, plotting strength envelope, determining shear strength parameters of soil	<b>04</b>	<b>08</b>
<b>Unit - 5</b>	<b>Bearing Capacity of Soils</b> 5.1 Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure 5.2 Terzaghi's analysis and assumptions made. 5.3 Effect of water table on bearing capacity 5.4 Field methods for determination of bearing capacity – Plate load test and standard penetration test. Test procedures as Per IS:1888 & IS:2131. 5.5 Typical values of bearing capacity from building code IS:1904 5.6 Definition of active earth pressure and passive earth pressure, structures subjected to earth pressure in the field.	<b>04</b>	<b>08</b>
<b>Unit - 6</b>	<b>Compaction of Soil &amp; Stabilization</b> 6.1 Concept of compaction, purpose of compaction field situations where compaction is required. 6.2 Standard proctor test – test procedure as per IS code, Compaction curve, optimum moisture content, maximum dry density, Zero air voids line. 6.3 Modified proctor test 6.4 Factors affecting compaction 6.5 Field methods of compaction – rolling, ramming & vibration and Suitability of various compaction equipments. 6.6 California bearing ratio, CBR test, significance of CBR value 6.7 Difference between compaction and consolidation 6.8 Concept of soil stabilization, necessity of soil stabilization 6.9 Different methods of soil stabilization – Mechanical soil stabilization, lime stabilization, cement stabilization, bitumen stabilization, fly-ash stabilization	<b>06</b>	<b>14</b>
<b>Unit - 7</b>	<b>Site Investigation And Sub Soil Exploration</b> 7.1 Necessity of site investigation & sub-soil exploration. 7.2 Types of exploration – general , detailed. 7.3 Method of site exploration open excavation & boring 7.4 Criteria for deciding the location and number of test pits and bores 7.5 Disturbed & undisturbed soil samples for lab testing. 7.6 Field identification of soil – dry strength test, dilitancy test & toughness test 7.7 Empirical correlation between soil properties and SPT values.	<b>04</b>	<b>08</b>
<b>Unit - 8</b>	<b>Liquefaction</b>	<b>03</b>	<b>06</b>
	<b>Total</b>	<b>30</b>	<b>70</b>

<b>Text/Reference Books:-</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Soil Mechanics & Foundation Engineering	Dr. B. C. Punmia	Standard Book house, New Delhi
Soil Mechanics & Foundation Engineering	Murthi	Tata McGraw Hill , New Delhi
Soil Mechanics	B. J. Kasmalkar	Pune Vidhyarti Griha, Pune
Geo-technical Engineering	Gulhati & Dutta	Tata McGraw Hill , New Delhi
Geo Technical Engineering	Kuldep Singh	Foundation Publishing



**TRANSPORTATION ENGINEERING**  
**(CIVIL ENGINEERING GROUP)**

<b>Subject Code</b> <b>1615404</b>	<b>Theory</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>	<b>03</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>	
	<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>	<b>:</b>	<b>20</b>	

**Contents: Theory**

<b>Name of the Topic</b>	<b>Hrs/week</b>	<b>Marks</b>
<b>Unit -1</b> <b>Overview of Transportation Engineering</b> 1.1 Role of transportation in the development of nation. 1.2 Modes of transportation system – roads, railway, airways, waterways, Importance of each mode, comparison and their relative merits and demerits. 1.3 Necessity & importance of Cross drainage works for roads & railways.	<b>02</b>	<b>04</b>
<b>Unit -2</b> <b>Railway Engineering.</b> 2.1 Alignment and Gauges Classification of Indian Railways, zones of Indian Railway. Alignment- Factors governing rail alignment. Rail Gauges – types, factors affecting selection of gauge. Rail track cross sections – standard cross section of BG & M.G Single & double line in cutting and embankment. 2.2 Permanent ways Ideal requirement, component parts. Rails – function & its types. Rail Joints – requirements, types, Creep of rail, causes & prevention of creep. Sleepers – functions & Requirement, types – wooden, metal, concrete sleepers & their suitability, sleeper density. Ballast – function & different types with their properties, relative merits & demerits. Rail fixtures & fastenings – fish plate, bearing plates, spikes, bolts, keys, anchors & anti creepers. 2.3 Railway Track Geometrics. Coning of wheels, tilting of rails, Gradient & its types, Super elevation limits of Super elevation on curves, cant deficiency negative cant, grade compensation on curves. 2.4 Branching of Tracks Definition of point & crossing, a simple split switch turnout consisting of points and crossing lines. Sketch showing different components, their functions & working. Line sketches of track junctions-crossovers, scissor cross over, diamond crossing, triangle. Inspection of points and crossings 2.5 Station and Yards : Site selection for railway stations, Requirements of railway station, Types of stations (way side, crossing, junction & terminal) Station yards , types of station yard, Passenger yards, Goods yard Locomotive yard – its requirements, water column , Marshalling yard – its types. 2.6 Track Maintenance- Necessity, types, Tools required and their function, organisation, duties of permanent way inspector, gang mate, key man	<b>18</b>	<b>26</b>

<b>Unit - 3</b>	<b>Bridge Engineering :</b> <b>3.1 Site selection and investigation</b> Factors affecting selection of site of a bridge. Bridge alignment Collection of design data Classification of bridges according to function, material, span, size, alignment, position of HFL. <b>3.2 Component parts of bridge.</b> Plan & sectional elevation of bridge showing component parts of , substructure & super structure. Different terminology such as effective span, clear span, economical span, waterway, afflux, scour, HFL, freeboard, etc. Foundation – function, types Piers-function, requirements, types. Abutment – function, types Wing walls – functions and types. Bearing – functions, types of bearing for RCC & steel bridges. Approaches –in cutting and embankment. Bridge flooring- open and solid floors <b>3.3 Permanent and Temporary Bridges-</b> Permanent Bridges - Sketches & description in brief of culverts, causeways, masonry, arch, steel, movable steel bridges, RCC girder bridge, prestressed, girder bridge, cantilever, suspension bridge. Temporary Bridges- timber, flying, floating bridges <b>3.4 Inspection &amp; Maintenance Of Bridge.</b> Inspection of bridges Maintenance of bridges & types – routine & special maintenance.	<b>18</b>	<b>26</b>
<b>Unit - 4</b>	<b>Tunnel Engineering.</b> 4.1 Definition, necessity, advantages, disadvantages 4.2 Classification of tunnels. 4.3 Shape and Size of tunnels 4.4 Tunnel Cross sections for highway and railways 4.5 Tunnel investigations and surveying –Tunnel surveying locating center line on ground, transferring center line inside the tunnel. 4.6 Shaft - its purpose & construction. 4.7 Methods of tunnelling in Soft rock-needle beam method, fore-poling method. line plate method, shield method. 4.8 Methods of tunnelling in Hard rock-Full-face heading method, Heading and bench method, drift method. 4.9 Precautions in construction of tunnels 4.10 Drilling equipments-drills and drills carrying equipments 4.11 Types of explosives used in tunnelling. 4.12 Tunnel lining and ventilation.	<b>10</b>	<b>14</b>
<b>Total</b>		<b>48</b>	<b>70</b>

<b>Text /Reference Books:-</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Railway Engineering	S.C. Saxena	Dhanpatrai & sons
Railway Track	K.R. Antia	The New Book Co. Pvt. Ltd Mumbai
Principles of Railway Engineering	S.C. Rangwala	Charotar Publication
Principles and Practice of Bridge Engineering	S.P. Bindra	Dhanpatrai & sons
A Text Book of Transportation Engineering	N.L. Arora and S.P. Luthra	IPH New Delhi
Elements of Bridge Engineering	J.S. Alagia	Charotar Publication
Bridge Engineering	D.R. Phatak	Everest Publisher

Elements of Bridges	D. Johnos Victor	Oxford & IBH Publishing co.
Road, Railway and Bridges	Birdi & Ahuja.	Std. Book House
Tunnel Engineering	S.C. Saxena	Dhanpatrai & sons
Explosive Engineering	C. B. Navalkar	--
Transportation Engineering	Bipin Sinha	Foundation Publishing
<b>2. IS / International Codes. :</b> IS 4880, I.S. 5878, Part-I to X.		

**HYDRAULICS**  
**(CIVIL ENGINEERING GROUP)**

<b>Subject Code</b> <b>1615405</b>	<b>Theory</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>	<b>03</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>	
<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>	<b>:</b>	<b>20</b>		

**Contents: Theory**

<b>Name of the Topic</b>		<b>Hrs/week</b>	<b>Marks</b>
<b>Unit -1</b>	<p><b>Properties Of Fluid</b></p> <p>1.1 Definition of fluid, Difference in behavior of fluid with respect to solids. Introduction to fluid mechanics and hydraulics, Branches of hydraulics- Hydrostatics and hydrodynamics, Importance of Hydraulics with respect to Irrigation and Environmental engineering.</p> <p>1.2 Physical properties of fluid Mass density, Weight density, Specific volume, Specific gravity, Surface tension and capillarity, Compressibility, Viscosity, Newton's law of viscosity – Dynamic and kinematics viscosity. Ideal and Real liquids</p>	<b>04</b>	<b>06</b>
<b>Unit -2</b>	<p><b>HYDROSTATIC PRESSURE</b></p> <p>2.1 Free liquid surface, Definition of pressure and its SI unit Hydrostatic pressure at point, Pascal's law Variation of pressure in horizontal and vertical direction in static liquid Pressure diagram.</p> <p>2.2 Total hydrostatic pressure and center of pressure, Determination of total pressure &amp; center of pressure on vertical &amp; inclined faces of dams, sluice gates, sides and bottom of water tanks, Determination of total hydrostatics pressure &amp; center of pressure on sides and bottom of tank containing two liquids. Determination of net hydrostatic pressure and center of pressure on vertical surface in contact with liquid on either side. Numerical Problems.</p>	<b>08</b>	<b>10</b>
<b>Unit - 3</b>	<p><b>Measurement Of Liquid Pressure In Pipes</b></p> <p>Concept of pressure head and its unit, Conversion of pressure head of one liquid in to other devices for pressure measurements in pipes – Piezometer, U-tube manometer, Bourdon's pressure gauge. Principle of working and limitations. Measurement of pressure difference using differential manometer – U-tube differential manometer and inverted U-tube differential manometer. Numerical Problems.</p>	<b>04</b>	<b>06</b>
<b>Unit - 4</b>	<p><b>Fundamentals Of Fluid Flow</b></p> <p>4.1 Concept of flow, Gravity flow and pressure flow. Types of flow – steady and Unsteady, uniform and non-uniform , Laminar and turbulent. Various combinations of flow with practical examples, Reynolds number and its application, Stream line and equipotential line. Flow net and its uses</p> <p>4.2 Discharge and its units Continuity equation for fluid flow. Datum head, pressure head, velocity head and total head, Bernoulli's theorem, Loss of head and modified Bernoulli's theorem, Impulse momentum theorem Numerical Problems.</p>	<b>06</b>	<b>08</b>

<b>Unit – 5</b>	<b>Flow Of Liquid Through Pipes</b> 5.1 Loss of head due to friction, Darcy-Weisbach Equation Friction factor, relative roughness. Moody's diagram and its use. Common range of friction factor for different types of pipe material. 5.2 Minor loss of head in pipe flow- loss of head due to sudden Contraction, sudden expansion, gradual contraction & expansion, at entrance and exit of pipe in various pipe fittings. Pipes in series and parallel Equivalent pipe – Dupuit's equation 5.3 Hydraulic gradient line and Energy gradient line, Siphon pipe. Water hammer in pipes – cause effects and remedial measures Use of Nomograms for design of water distribution system. Numerical	<b>07</b>	<b>10</b>
<b>Unit – 6</b>	<b>Flow Through Open Channel</b> 6.1 Types of channels- artificial & natural, purposes of artificial channel, Different shapes of artificial channels Geometrical properties of channel section-wetted area, wetted Perimeter, hydraulics radius Prismatic channel sections, steady-uniform flow through prismatic channel section. 6.2 Chezy's equation and Manning's equation for calculation of discharge through an open channel, common range of values of Chezy's constants and Manning's constant of different types of channel surfaces. Most economical channel section, conditions for most economical channel sections. 6.3 Froud's number and its significance. Critical, sub-critical and supercritical flow in channel Hydraulic jump its occurrence in field, uses of hydraulic jump.	<b>07</b>	<b>14</b>
<b>Unit – 7</b>	<b>Flow Measuring Devices</b> 7.1 Velocity measuring devices for open channels. Floats-surface, sub-surface and float rod, Pitot tube – principle, expression for velocity Current meter-cup type & propeller type 7.2 Discharge measuring devices for channels , Notches -Types of notches, expression for discharge. Francis formula, end contraction and velocity of approach Weirs - Broad crested weir, ogee spillway, and expression for discharge. Flumes - Venturi flume, standing wave flume, expression for discharge. Velocity area method for measurement of discharge through open channels. Discharge measuring devices for pipes. 7.3 Venturimeter – Component parts, principle of working, Study and use of Water meter Flow through orifice Orifice- Definition and use, Types of orifice based on various criteria. Coefficient of contraction, coefficient of velocity and coefficient of discharge, Relationship between them. Discharge through small sharp-edged circular orifice Determination of hydraulic coefficient of orifice. Numerical.	<b>08</b>	<b>10</b>
<b>Unit – 8</b>	<b>Hydraulic Machines</b> Pumps - Definition and types. Suction head, delivery head, static head and manometric head. Centrifugal pump - component parts and their functions, principle of working, priming. Reciprocating pump - component parts and working. Submersible pump and Jet pump. Selection and choice of pump. Computation of power required for pumps. Turbines - Definition and types.	<b>04</b>	<b>06</b>
<b>Total</b>		<b>48</b>	<b>70</b>

<b>Text/Reference Books:-</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Hydraulics & Fluids Mechanics	Dr. P.N.Modi & Dr. S.M.Seth	Standard Book House, Dehli
Hydraulics & Fluids Mechanics	S.Ramamrutham	Dhanpat Rai & Sons, Delhi
A Text Book of Hydraulics, Fluids Mechanics Hydraulics Machines	R.S.Khurmi	S.Chand & Company Ltd. New Delhi
A Text Book of Fluids Mechanics Hydraulics Machines	R.K.Rajput	S.Chand & Company Ltd. New Delhi
Fluids Mechanics Hydraulics	Dr. Jagdish Lal	Metropolitan Book Co. Private Ltd. New Delhi
Hydraulics Laboratory Manual	S.K.Likhi	T.T.T.I. Chandhigrah
Flow Through open Channels	K.G. Ranga Raju	Taio McGraw. Hill Publishing Company Ltd. New Delhi.
Hydraulics	B.K. Singh	Foundation Publishing

**ADVANCE SURVEYING LAB**  
**(CIVIL ENGG. GROUP)**

<b>Subject Code</b> <b>1615406</b>	<b>Practical</b>						<b>Credits</b>  <b>02</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>	
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>	
	—	—	<b>04</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
	-	-	-	<b>External</b>	<b>:</b>	<b>35</b>	

**Contents: Practical**

**SKILLS TO BE DEVELOPED:**

**INTELLECTUAL SKILL:**

- 1) Identify the components of plane table, theodolite, and advanced survey instruments.
- 2) Know the working principles of these survey instruments.
- 3) Finding the horizontal and vertical distances.
- 4) Identifying errors in setting out curve and tabulating elements of a curve.

**Motor Skills:**

- 1) Taking and recording the observation in the field book.
- 2) Preparing drawings, maps etc. with the observed data.
- 3) Setting out curve for the given alignment.
- 4) Use Micro optic thodolite, EDM for finding different parameters.

**Instructions:-**

- 1) Group size for Practical work should be limited to maximum 6 Students.
- 2) Each student from the group should handle the instrument to understand. the function of different components and use of the instrument.
- 3) Drawing, plotting should be considered as part of practical.
- 4) One full day per project is required for carrying out project work, which is to be plotted on a drawing sheet.
- 5) **TERM WORK** SHOULD CONSIST OF RECORD OF ALL PRACTICALS AND PROJECTS, IN FIELD BOOK AND DRAWING SHEETS FOR THE GIVEN PROJECTS.

**LIST OF PRACTICAL: (MINIMUM 12 PRACTICAL FROM LIST GIVEN BELOW)**

- 1) USING ACCESSORIES CARRY OUT TEMPORARY ADJUSTMENTS OF PLANE TABLE.  
LOCATING DETAILS BY METHOD OF RADIATION.
- 2) Locating details with plane table by method of intersection.
- 3) Understanding the components of Theodolite and their functions, reading the vernier and temporary adjustments of theodolite.
- 4) Measurement of Horizontal angle by transit theodolite.
- 5) Measurement of Horizontal angle by method of Repetition.
- 6) Measurement of vertical angles by theodolite.
- 7) Measurement of Magnetic bearing of a line using theodolite.
- 8) Measurement of deflection angle by taking open traverse of 4 –5 sides.
- 9) To find Reduced levels and horizontal distances using theodolite as a Tacheometer.
- 10) To find constants of a given Tacheometer.
- 11) Study and use of 1 second Micro Optic Theodolite for measurement of Horizontal and Vertical angles
- 12) Study of E.D.M. for knowing its components.
- 13) Use of EDM for finding horizontal and vertical distances and reduced levels.
- 14) Determine the geographical parameters by total station.

**List Of Projects:**

- 1) Plane table survey project for 5-6 sided traverse and locating details of buildings , Roads etc. by radiation and Intersection method , Sheet to be drawn by each student separately on A-1 size imperial drawing sheet.
  
- 2) Theodolite traverse Survey for a closed traverse of 5-6 sides for a small area. Computation by Gale's traverse table. Plotting the traverse with details on A1 size imperial drawing sheet.
  
- 3) Setting out simple circular curve by Rankine's method of Deflection angles for a given problem and plotting the details of curve on A-1 size imperial drawing sheet



**MECHANICS OF STRUCTURE LAB**  
**(CIVIL ENGG. GROUP)**

<b>Subject Code</b> <b>1615407</b>	<b>Practical</b>						<b>Credits</b>  <b>01</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>	
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>	
	—	—	<b>03</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
	-	-	-	<b>External</b>	<b>:</b>	<b>35</b>	

**Contents : Practical**

**Skill to be developed:**

**Intellectual Skills:**

1. Interpret the results.

Calculate design parameters.

**Motor Skills:**

1. Observe the phenomenon during testing of specimen.
2. Draw the graphs and diagrams.

**List of Practical:**

**Group – A (Any Six)**

1. Identify the components of universal testing machine & tension test on mild steel.
2. Tension test on mild steel / deformed bars .
3. Izod Impact test on mild steel, brass, copper and cast iron.
4. Charpy impact test on mild steel, brass, copper and cast iron.
5. Flexural test on timber.
6. Flexure test on floor tiles or roofing tiles.
7. Shear Test on metal.
8. Water Absorption & Compression test (Dry & Wet) on bricks
9. Abrasion Test on flooring tiles.

**Group - B**

1. Drawing of Shear force and Bending Moment diagrams on Graph Paper (6 Problems)
2. Graphical Solution of Two Problems on simple frames i) Cantilever  
ii) Simply supported on A2 size sheet with their analytical solutions

**GEO TECHNICAL ENGG. LAB**  
**(CIVIL ENGG. GROUP)**

<b>Subject Code</b> <b>1615408</b>	<b>Practical</b>						<b>Credits</b>  <b>01</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>	
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>	
	—	—	<b>02</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
	-	-	-	<b>External</b>	<b>:</b>	<b>35</b>	

**Contents: Practical**

**Skills to be developed:**

**Intellectual Skills:**

- a. Identify properties of soil.
- b. Interpret test results.
- c. Follow IS procedure of testing.

**Motor Skills:**

- a. Measure the quantities accurately.
- b. Handle the instruments carefully.

**List of Practical (Any ten):-**

1. Determination of water content of given soil sample by oven drying method as per IS Code.
2. Determination of bulk unit weight dry unit weight of soil in field by core cutter method as per IS Code.
3. Determination of bulk unit weight dry unit weight of soil in field by sand replacement method as per IS Code.
5. Determination of Liquid limit & Plastic limit of given soil sample as per IS Code.
6. Determination of grain size distribution of given soil sample by mechanical sieve analysis as per IS Code.
7. Determination of coefficient of permeability by constant head test
8. Determination of coefficient of permeability by falling head test  
Practical (Live demo or Prerecorded demo)
9. Determination of shear strength of soil using direct shear test.
10. Determination of shear strength of soil using Laboratory Vane shear test
11. Determination of MDD & OMC by standard proctor test on given soil sample as per IS Code.
12. Determination of CBR value of given soil sample.
13. Determination of shear strength of soil using unconfined compressive strength.
14. Determination of shear strength of soil using tri-axial shear test.

**HYDAULICS LAB**  
**(CIVIL ENGG. GROUP)**

<b>Subject Code</b> <b>1615409</b>	<b>Practical</b>						<b>Credits</b>  <b>02</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>	
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>	
	<b>—</b>	<b>—</b>	<b>04</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
	<b>-</b>	<b>-</b>	<b>-</b>	<b>External</b>	<b>:</b>	<b>35</b>	

**Contents : Practical**

**Skills to be developed:**

**Intellectual Skills:**

- a. Interpret test results
- b. Calculate quantities of parameters
- c. Draw graphs

**Motor Skills:**

- a. Measure different parameters accurately
- b. Adjust levels by operating valves

**List of Practical:**

1. Measurements of pressure and pressure head by Piezometer, U-tube manometer
2. Measurement of pressure difference by U-tube differential manometer. Study of bourdon's gauge
3. Verification of Bernoulli's theorem
4. Reynolds experiment to study types of flow.
5. Determination of Darcy's friction factor for a given pipe
6. Determination of Minor losses in pipes (any two)
7. Study and use of Moody's diagram, Nomogram of Manning's equation
8. Determination of Manning's constant or Chezy's constant for given rectangular channel section.
9. Demonstration of Hydraulic jump
10. Determination of coefficient of discharge for given rectangular or triangular notch.
11. Determination of coefficient of discharge for a given Venturimeter.
12. Demonstration and use of Pitot tube and current meter
13. Determination of hydraulic coefficients for sharp edge orifice.
14. Study & use of water meter.
15. Study of a model of centrifugal and reciprocating pump.
16. Use of characteristic curves/ nomograms /charts / catalogs from manufactures for selection of pump for the designed discharge and head (Refer IS: 9694)

**PROFESSIONAL PRACTICES IV-TW**  
**(MECH.+CIVIL ENGINEERING GROUP)**

<b>Subject Code</b> <b>1625410</b>	<b>Term Work</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>25</b>	<b>02</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>	<b>07</b>	
	—	—	<b>03</b>	<b>External</b>	<b>:</b>	<b>18</b>	

**CONTENTS :TERM WORK**

<b>Name of the Topic</b>	<b>Hrs/week</b>
<b>Unit -1</b> Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work. The industrial visits may be arranged in the following areas / industries (Any three) i) Bridge under construction ii) Adarsh Gram iii) Railway station iv) Construction of basement/retaining wall/sump well	<b>20</b>
<b>Unit -2</b> Lectures by Professional / Industrial Expert / Student Seminars based on information search, expert lectures to be organized from any two of the following areas: i) Construction of Flyovers: Special Features ii) Ready Mix concrete iii) Safety in Construction iv) Latest Trends in Water proofing v) Software for drafting	<b>10</b>
<b>Unit - 3</b> Information search can be done through manufacturers, catalogue, internet, magazines; books etc. and submit a report.(any three) Following topics are suggested : i) Collection and reading of drawings of buildings from architect / Practicing engineers and listing of various features from the drawings. ii) Market survey for pumps ,pipes and peripherals required for multi storied buildings iii) Non Conventional Energy Sources with focus on solar energy iv) Elevators installation and maintenance v) Any other suitable areas	<b>14</b>
<b>Unit - 4</b> <b>Seminar :</b> Seminar topic should be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time - 10 minutes)	<b>16</b>
<b>Unit - 5</b> <b>Mini Project / Activities :(any one)</b> a) Optimum design of concrete b) Preparing three dimensional model of residential building using CAD	<b>20</b>
<b>Total</b>	<b>80</b>

**COMPUTER AIDED DRAWING - TW**  
**(CIVIL ENGINEERING GROUP)**

<b>Subject Code</b> <b>1615411</b>	<b>Term Work</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>25</b>	<b>02</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>	<b>07</b>	
	—	—	<b>03</b>	<b>External</b>	<b>:</b>	<b>18</b>	

**CONTENTS: TERM WORK**

	<b>Name of the Topic</b>	<b>Hrs/week</b>
<b>Unit -1</b>	<b>CAD Software</b> Meaning, various CAD software available in the market AutoCAD, Felix Cad, Auto Civil, 3D Max ; etc.)Starting up of CAD, CAD Window, Tool bar, Drop down menu, Command window, Saving the drawing. Introduction of Graphic screen.	
<b>Unit -2</b>	<b>CAD Commands</b> WCS icon, UCS icon, co-ordinates, drawing limits, grid, snap, ortho features. Drawing commands, line, circle, polyline, multiline, ellipse, polygon etc. Editing commands – Copy, move, offset, fillet, chamfer, trim, lengthen, mirror, rotate, array etc. Working with hatches, fills, dimensioning, text etc.	
<b>Unit - 3</b>	<b>Submission / Working Drawing</b> Generation of line plan, Detailed Plan, elevation, section, site plan, Area statement Generation of 3D view and print commands Introduction to Auto Civil , 3D Max.	

**Note:** Above theoretical aspects should be covered in the practical periods.

**A) Building Drawing:**

Following exercises shall be completed with CAD software and Print of all the drawings should be prepared on A3 / A4 size paper

- 1) Preparation of line plan of a residential building.
- 2) Preparation of line plan of a Public building.
- 3) Preparation of detailed plan of a small residential building .
- 4) Preparation of submission drawing of residential building – showing Plan, Elevation, Section, Schedule of openings, Site Plan and Area Statement

**B) Civil Engineering Drawing.**

Preparation of Drawings with CAD software for the following exercises (Any THREE) and Print of all the drawings should be prepared on A3 /A4 size paper.

- 1) Plan, Cross Section and Longitudinal section of a Culvert (Pipe culvert/Box Culvert).
- 2) Section of an Earthen Dam.
- 3) Plan and Section of K. T. Weir.
- 4) Cross Section of Retaining wall.
- 5) Bonds in brickwork – Plan and Elevation for English bond and Flemish bond for one brick thick wall.
- 6) Cross Section of ESR.
- 7) Cross Section of Clarri-flocculator.

<b>Text Reference Books:-</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Reference Manual of AutoCAD	AutoDesk	
Reference Manual of Felix cad	Felix CAD	
Reference Manual of Intel CAD	--	
Reference Manual of Auto Civil	--	
Reference Manual of 3D- Max	--	
Computer Aided Drawing	R.C. Tayal	Foundation Publishng