CIVIL ENGINEERING

T.Y. B. Tech.
Effective from A. Y. 2013-14

INDEX

List of Abbreviations

Sr. No.	Abbreviation	Stands for:
1	DEC	Departmental Elective Course
2	PSC	Professional Science Course
3	PCC	Program Core Course
4	LC	Laboratory Course
5	HSSC	Humanities and Social Science Course
6	MLC	Mandatory Learning Course
8	LLC	Liberal Learning Course
9	BSC	Basic Science Course

Program Educational Objectives (PEOs):

1. To prepare students for successful careers in the diversified sectors of the industry that meet the needs of Indian and multinational companies, government organizations, public sector and multinational corporations.

2. To develop the ability among students to synthesize data and technical concepts for application to design structural elements.

3. To provide opportunity for students to work as part of teams on multidisciplinary projects.

4. To provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems and to prepare them for higher studies in civil or other fields of their interests, at institutes of repute and high standard.

5. To provide students experience with the multifaceted aspects of using computers to solve problems and present results with word processing, spreadsheet, presentation and professional level applications software used for design and analysis and to provide for obtaining and the use of information on the world wide web.

6. To provide students a familiarity with professional issues in civil engineering including: ethics, issues related to the global economy and to emerging technologies, and fostering of important job related skills such as improved oral and written communications and experience in working in teams at a number of levels.

Program Outcomes (POs):

a. Graduates will demonstrate basic knowledge in mathematics, science and engineering.

b. Graduates will demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results.

c. Graduates will demonstrate the ability to design various structures or particular system that meets desired specifications and requirements.

d. Graduates will demonstrate the ability to function on engineering and science laboratory teams, as well as on multidisciplinary design teams.

e. Graduates will demonstrate the ability to identify, formulate and solve civil engineering problems.

f. Graduates will demonstrate an understanding of their professional and ethical responsibilities.

g. Graduates will be able to communicate effectively in both verbal and written forms.

h. Graduates will have the confidence to apply engineering solutions in global and societal contexts.

i. Graduates should be capable of self-education and clearly understand the value of lifelong learning.

j. Graduates will be broadly educated and will have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.

k. Graduates will be familiar with modern engineering software tools and equipment to analyze civil engineering problems.

CURRICULUM STRUCTURE OF T. Y. B.TECH (CIVIL)

Effective from A. Y. 2013-2014

I-Semester:

Sr. No	Course Type/ code	Subject Title	Contact hours			Credits
			L	**T**	**P**	
01	BSC/AS- 09001	Applied Biology	3	-	-	3
02	PCC/CE- 09003	Geotechnical Engineering	3	-	-	3
03	PCC/CE- 09004	Advanced Surveying	3	-	-	3
04	PCC/CE- 09005	Structural Analysis	3	-	-	3
05	PCC/CE- 09002	Design of Steel Structures	3	-	-	3
06	PCC/CE- 09001	Tunnel, Docks & Harbour and Railway Engineering	3	-	-	3
07	LC/CE- 09006	Geotechnical Engineering Laboratory	-	-	2	1
08	LC/CE-09007	Advanced Surveying Laboratory	-	-	2	1
09	LLC/LL-09001	Refer to Annexure II	1	-	-	1
10	MLC/ML-09001	Constitution of India	2	-	-	2
		Total	**21**	**0**	**4**	**23**

II-Semester:

Sr. No	Course Type/ code	Subject Title	Contact hours			Credits
			L	**T**	**P**	
01	OEC or SEC	Open Elective/Science Elective Course Refer to Annexure I	3	-	-	3
02	PCC/CE-09008	Environmental Engineering	3	-	-	3
03	PCC/CE -09009	Construction Management	3	-	-	3
04	PCC/CE 09010	Hydrology and Irrigation Engineering	3	-	-	3
05	PCC/CE-09011	Foundation Engineering	3	-	-	3
06	PCC/CE-09012	Design of RCC Structures	3	-	-	3
07	LC/CE-09013	Design of Steel Structures Lab	-	-	2	1
08	LC/CE-09014	Environmental Engineering Lab	-	-	2	1
09	LC/CE -09015	Construction Management Lab	-	-	2	1
10	HSSC/AS-09002	Humanities Course	2	-	-	2
		Total	**20**	**0**	**6**	**23**

AS - 09001   Applied Biology

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz–40 marks,
End - Sem Exam – 60 marks

Unit 1 **(6 hrs)**
Origin of life. Molecules of life- biomolecules. Cell as the unit of life.
 Development of cell   theory. Cell types : prokaryotes and. eukaryotes; cell organelles, single cell to multi-cellular organism, tissue and organ level organization, organ systems
Structure of the cell membrane. Fluid mosaic model. Functions of plasma membrane; diffusion, osmosis, membrane transport through plasma membrane, ion channels and electrical properties.

Unit 2 **(6 hrs)**
Energy Transduction and Bioenergetics. Mitochondria, ATP, Chemiosmosis, ATPase,Cell to cell junction-gap junctions. Ultra structure of Chloroplast,   photosynthetic electron transport, Calvin cycle
Cell architecture, cyto-skeletal components, microtubules and microfilaments,
motility and motor motions, actomyosin complex
Genomics and proteomics

Unit 3 **(6 hrs)**
Evolution of biological machines- Optimization of biological machines at different levels- molecular, cellular, organismal and populational; principles of generating diverse body plans and design in nature
Biomaterials. Applications of nanotechnology in biology. Biosensors & their application

Unit 4 **(6 hrs)**
Bioengineering- genetic engineering, protein engineering, tissue engineering and biochemical engineering.
Computational biology and bioinformatics

Unit 5 **(6 hrs)**
Biomechanics - fluid mechanics , examples in living world, aerodynamic, hydrodynamic and locomotion, mechanism of motion, friction and fracture.   Application of biomechanics and biomaterials- Human body motion, use of prosthetics, rehabilitation application

Unit 6 **(6 hrs)**
Instrumentation in biology- spectroscopic methods, bioimaging using various techniques eg. MRI, CT scan ect.
Green environment- use of biotechnology in environmental engineering

References :
- Molecular Biology of Cell by Alberts.
- Biochemistry of Cell by Lehninger
- Plant Physiology by N.K.Sinha & Pandye
- Genes 8 by Benjamin Lewin
- A Text Book of Environmental Engineering by P. Venugopal Rao
- Animal Tissue Culture by Ian Freshlly

Course outcome
1.The students received knowledge about latest studies in biology like genetic & tissue engineering, stem cells, biomechanics, bioimaging, bio-nanotechnology etc.
2. The students understood the role of engineers in biology.
3.The students were provoked to make use of their engineering knowledge in different fields of biology.
4. The students made use of this knowledge in their different projects.

(Entire course should be taught at introductory level)

CE-09003   Geotechnical Engineering

Teaching Scheme
Lectures : 3hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1 **(7 hrs)**

Properties of Soil:
Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits and desert soils. Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance, I.S. classification of soil.

Unit 2 **(7 hrs)**

Permeability and Seepage:
Darcy's law. Factors affecting permeability. Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I)- pumping in test and pumping out test. Permeability of layered soils. Seepage forces. General flow equation. Flow

net and its applications.

Unit 3   (7 hrs)

Compaction:
Soil compaction phenomenon. Factors affecting compaction. Dry density and moisture content relationship. Zero air voids line. Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods for cohesive and non-cohesive soils.

Unit 4   (7 hrs)

Shear Strength of Soil :
Mohr circle of stress, Mohr-coulomb failure criteria, pore pressure, total and effective stress. Peak and residual shear strength. Factors affecting shear strength. Laboratory measurement of shear strength by direct, unconfined and triaxial tests under different drainage conditions. Vane shear test.

Unit 5   (7 hrs)

Stress Distribution in Soils:
Boussinesq theory- point load, pressure distribution due to   line load, strip load, pressure bulb, Westergaard's theory, contact pressure, approximate stress distribution method.

Unit 6   (7 hrs)

a) Lateral Earth Pressure:
Earth pressure on vertical wall, effect of wall movement on earth pressure, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's theory.
b) Stability of Slopes:
Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesionless soil, slope stability analysis using Swedish Slip Circle Method.

Note- More emphasis would be given on basic fundamentals in the course work.

Text Books
- Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", G. K. Publications pvt. Ltd
- V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", B.S.Publications (3rd Edition)
- B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publishing Co., New Delhi.
- Dr. B. J. Kasmalkar ,"Geotechnical Engineering", Pune Vidyarthi Griha Prakashan, 1986

Reference Books
- Joseph E Bowles, "Engineering Properties of Soils And Their Measurements", McGraw Hill Publications(2001)

- Lambe and Whitman ,"Soil Mechanics", S.Chand publications(SI Version),
- Donald P Coduto, "Geotechnical Engineering Principle and practice",McMillan Press (PHI)
- P Purushothma Raj ,"Geotechnical Engineering", McGraw Hill Publication(4th Edition)

Outcomes:

A. Students will be able to identify type of soil and various stresses acting on it.
B. Students will be able to Understand and apply basic soil mechanics principle to identify various properties of soil
C. Students will be able to suggest suitable compaction method.
D. Students will be able to identify various forces acting on the retaining wall and design retaining wall.

CE - 09004   Advanced Surveying

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1   (7hrs)

Geodetic Surveying:
Objects, Methods in Geodetic surveying, Trilateration, Classification of triangulation systems, Triangulation figures, Strength of figure & derivation for well conditioned triangle, Selection of stations, intervisibility & height of stations, Towers signals & their classifications, Phase of signals & their corrections. Satellite stations, Reduction to center. Reduction to mean sea level and extension of base.

Unit 2   (7 hrs)

Triangulation Adjustment :
Kinds of errors, Laws of weights, Determination of Most probable values [MPV] of conditioned and independent quantities, Method of least squares, probable error and its determination, Distribution of error to the field measurement. Normal equation, Method of correlates, station adjustment and figure adjustment of Geodetic triangle [without central station] and Geodetic Quadrilateral [without central station], Spherical triangle, calculations of spherical excess and sides of spherical triangle.

Unit 3   (7 hrs)

Hydrographic Surveying:
Objects, Establishing controls, Shoreline survey, soundings, Equipments for measuring soundings and method of locating soundings, Reduction of soundings, Plotting of soundings, Three point problem and its solution by Analytical and Graphical methods. Tides and tide

gauges, Nautical sextant and its use.

Unit 4 (8 hrs)

Remote Sensing:
Basic principles, Electromagnetic spectrum, Interaction mechanism and image formation, Classification of remote sensing systems, platforms for sensing different types of data products, Applications to Civil Engineering, concept of global positioning systems [GPS] and differential GPS.

Unit 5 (7 hrs)

Aerial Photogrammetry:
Objects, Applications to various fields, Aerial camera, Comparison of map & vertical photograph, Vertical tilted and oblique photographs, scale of vertical photograph, computation of length and height from the photograph, Relief displacement on vertical photograph. Mirror Stereoscope, Flight planning, Ground control, Radial line method, parallax equation, Mosaics, Photo interpretation.

Unit 6 (6 hrs)

Modern Surveying Instruments:
Electromagnetic waves and their properties, phase, phase comparison, Modulation, Types of Electromagnetic Distance Meters [E.D.M.]–Geodimeter, Tellurometer, Distomat. Total Station and its uses.

Text Books
- T.P.Kanetkar & S.V.Kulkarni, "Surveying and Leveling Vol. II", Pune Vidhyarthi Gruh
- Dr. B.C.Punmia ,"Surveying Vol. II & III", Laxmi Publications (P) Ltd., New Delhi.
- Dr. K.R.Arora ,"Text book in Surveying Vol. II & II", McMillan Publication

Reference Books
- J. Uren and W.F.Price, "Surveying for Engineer", McMillan Publication
- Anderson, "Introduction to Surveying", McGraw Hill Publication
- Paul R Wolf,"Elements of Photogrammetry", McGraw Hill Publication
- J.M.Kennie and M.C.Matthews ,"Remote Sensing in Civil Engineering", McGraw Hill Publications(2010)

Outcomes:
Student can do survey for a large area.

CE - 09005   Structural Analysis

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1   **(7 hrs)**

Analysis of indeterminate Structures by Displacement Methods
A) Slope deflection method
B) Moment distribution method
Applications to non sway and sway frames

Unit 2   **(7 hrs)**

Flexibility method of analysis: Formulation of flexibility matrix. Application to beams, pin-jointed plane trusses and rigid jointed rectangular plane frames, Settlement of supports.

Unit 3   **(7 hrs)**

Stiffness method of analysis: Formulation of stiffness matrix. Applications to beams, pin-jointed plane trusses and rigid jointed rectangular plane frames.

Unit 4   **(7 hrs)**

Arches –Three hinged and two hinged arches. Parabolic and Semi Circular arches. Influence Lines

Unit 5   **(7 hrs)**

Numerical Methods
Finite difference method – Backward, central, forward differences, Gauss Elimination Method, Newton-Raphson Method, application to deflection of beams, column buckling.

Unit 6   **(7 hrs)**

Approximate methods of analysis of multistoried, multi bay rigid jointed frames.
        (i) Portal method   (ii) Cantilever method   (iii) Substitute frame method

Text Books
- R. C. Hibbeler, "Structural Analysis", Pearson Education Publication
- Pandit and Gupta , "Theory of Structures", Tata McGraw Hill Publication.
- N. Krishna Raju , "Numerical Methods for Engineering Problems", Macmillan Publishers India Limited, 2/e

Reference Book
- Wilbur and Norris ,"Elementary Structural Analysis":Tata McGraw Hill Publication(6th Edition)
- Gere and Weaver ,"Matrix Analysis of Framed Structures",CBS Publication Delhi

Outcomes:
At the end of this course the student would be able to
- analyse the structures using matrix methods
- apply numerical methods such as finite difference method for the analysis of structures
- learn and understand concept of arches
- perform approximate analysis of highly indeterminate structures

CE - 09002   Design of Steel Structures

Teaching Scheme   **Examination Scheme**
Lectures : 3 hrs/week   100 marks: Continuous evaluation-
                                            Assignments /Quiz- 40 Marks,
                                            End - Sem Exam – 60 Marks

(8 hrs)

Unit 1

Introduction to structural design, Structural systems, Role of the designer, Advantages of steel as a structural material, Types of structural steel, Mechanical properties of steel, various rolled steel sections (including cold-formed sections, structural pipe (tubes)) sections and their properties.
Design philosophies: Introduction to working stress method, Limit state method. Introduction to Plastic theory: Plastic hinge concept, Plastic collapse load, Plastic moment, Shape factor, Plastic section modulus.
Types of loads acting on structure, Introduction to IS Codes and specifications: IS 875, IS 800 – 2007.

Unit 2   **(8 hrs)**

Bolted connections: Types of bolts, Behavior of bolted joints. Strength of joint, efficiency of joint, Analysis and   Design of simple connections, Beam to beam, beam to column.
Welded connections: Types and properties of welds, Types of joints, Design of simple connections, Beam to beam, beam to column.
Analysis and   design of moment resisting bolted and welded connection

Unit 3   **(6 hrs)**

Tension members: Behavior, Modes of failure, and Design of single and double angle sections.

Unit 4   **(6 hrs)**

Compression Members: Behavior, Modes of failure, Classification of cross section, Effective length, slenderness ratio, Design strength, Compression members in trusses.

Unit 5   **(6 hrs)**

Design of beams: Laterally restrained and unrestrained simply-supported beams.   Design of compound beams and welded plate girder. Curtailment of flange plates.

Unit 6   **(6 hrs)**

Design of columns subjected to axial load and biaxial bending, Built up column sections, Laced and Battened columns. Column bases: Slab base and Gusseted base.

Text Books
- N. Subramanian," Design of Steel Structures", Oxford University Press.
- V.L. Shah , Veena Gore, "Limit State Design of Steel Structures", Structures Publications
- S.S. Bhavikatti, "Design of Steel Structures by Limit State Method", I.K International Publishing House Pvt. Ltd.

Reference Books:
- IS 800 'General Construction in Steel- code of Practice' (Third Revision) (2007)

Outcomes:
After learning this course students will be able to
- understand the use of I S Codes related to structural design of steel   structures
- Design various components of a steel structure like beams, columns, axial force members in a truss and their bolted and welded connections as per limit state method of design.
- Prepare detailed structural drawings of a steel structure.

CE - 09001   Tunnel, Docks & Harbour and Railway Engineering

Teaching Scheme   **Examination Scheme**
Lectures : 3 hrs/week   100 marks: Continuous evaluation-
Tutorial : ----   Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1   **(4 hrs)**

Railway Engineering: Introduction
History of Indian Railways, Component parts of railway track, recent development in railways

specifically w.r.t. track structure, Organizational structure of Indian railways, railway lines classification based on speeds such as A,B,C,D,E,Q,R and S routes.

Permanent way Component Parts

Types of rail sections, Coning of wheels, Rail creep, Rail defects, Rail joints, welding of rails, short welded rail (SWR), long welded rail (LWR) & continuously welded rail (CWR), sleepers requirement, Sleeper density, spacing, and types, Rail fittings, Elastic fastenings, bearing plates, anti-creep devices, check and guard rails, Ballast requirements and specification, Formation, Different cross sections of Track in cutting & embankment, suitability of drainage.

Unit 2 (4 hrs)

Geometric Design

Necessity, types of Gradients, curves, Grade Compensation on curves, Alignment, Super elevation, Equilibrium cant; & cant deficiency, speed on curves, safe speed on curves using Indian railway formula only for fully transitioned curves. Gauge widening.

Points, crossing and turnouts

Functions, various types of track junction & their configurations, Listing of types of Turnouts.

Signaling & Interlocking

Objects, classification, control of train movements and monitoring, types of signals, principal of interlocking, Modernization in Railways and railway tracks, High speed tracks.

Unit 3 (10 hrs)

General Introduction about Tunnels

Advantages and disadvantages of tunnel with respect to open cuts. Geotechnical Exploration for tunnels and its importance.

Tunnel surveying

Surface surveys, Transferring centerline, Setting out and Transfer of Levels. Underground. Criteria for Selection of size and shape of tunnels, Factors affecting the methods of Tunneling.

Driving Tunnels in Soft ground

General, Characteristics of soft ground, Needle beam method, and 'NATM' method of Tunneling

Unit 4 (10 hrs)

Driving tunnels in hard ground

Sequence of operation and typical distribution of time for each operations, Meaning of the term 'Faces of Attack', Drill blast method of tunneling for hard strata, Different patterns of drilling.

Blasting and explosives

Meaning of the terms, types of explosives, method of blasting in brief.

Ventilation

Meaning of the term, requirements a ventilating system, Methods of ventilation with advantages and disadvantages. Lighting and aspects of drainage in brief. Method of supporting roof consisting of shot creating. Cement grouting, rock bolting, Cast in-situ and precast lining.

Unit 5 (7 hrs)

Docks and Harbour:Introduction, Definition of the terms associated with docks and harbour,

Requirements of harbour and port, classification of harbours with examples. Factors affecting Factors affecting growth of port, Major Ports in India and abroad, Planning a Port, Selection of ideal location of harbour, Introduction to dredging

Unit 6 (7 hrs)

Breakwater and materials of construction for breakwater, Introduction to design of break waters, Dock, Bulkhead and Sea Walls, Design Considerations and Construction Materials, Revetments, Water front structures, Wharves, Jetty, Dolphins, Different types of dock fenders, Uses of wet docks and Dry/ Repair docks. Port facilities, Transit sheds and warehouses.

Text Books
- S.K.Sharma,"Docks and Harbour Quinn", McGraw Hill
- Subhash C. Saxena, "Tunnel Engineering", Dhanpat Rai & Sons - New Delhi.
- S.C. Saxena, Arora," A Textbook of Railway Engineering", Dhanpat Rai & Sons, Delhi.

Reference Books
- J.S. Mundrey ,"Railways Track Engineering",Tata Mcgraw Hill, New Delhi.
- S.C. Rangawala,"Principals of Railway Engineering", Charotkar Publishing(Volume 3)
- V.N. Vazirani and S.P. Chandola,"Transportation Engineering",Dhanpat Rai Publications
- G. V. Murthy, "Tunnels and Elements of Docks and Harbours"
- Vicksburg, "Coastal Engineering Manuals Volume I and II", US Army Corps of Engineers.
- S. C. Saxena, "Tunnel Engineering", McMillan Publications.

Outcomes:
1) The students get basic study of various component parts & processes to run railway engineering system including permanent way, geometric design, signaling systems, etc.
2) Similarly students get knowledge regarding fundamentals of tunnel its excavation methods, support systems, and executional aspects of tunnel.
3) The students learn the navigational mode of transportation in which he gets basic information of harbour, port, dock and design of various component parts of docks & harbor and their functioning.

CE - 09006   Geotechnical Engineering Laboratory

Teaching Scheme   **Examination Scheme**
Practical: 2 hrs/week   Term-work: 50 Marks
                                                     Oral: 50 Marks

I) Laboratory Experiments to be conducted

1. Specific gravity determination by voluminometer / pycnometer / density bottle.
2. Sieve analysis, particle size determination and I. S. classification.
3. Determination of consistency limits and its use in soil classification.
4. Field density test by core cutter, sand replacement method.
5. Determination of co-efficient of permeability by constant head and by variable head

method.
6. Direct shear test.
7. Standard proctor test.
8. Unconfined Compression Test

A Laboratory Record based on the laboratory experiments would be submitted for the term-work. Oral Examination would be based on the term work and theory covered in the class under the subject CE-301: - GEOTECHNICAL ENGINEERING. Course Teacher for the Laboratory would decide the breakup to Oral Examination.

Outcome:
This lab course will enable the students to
 • Determine properties of various types of soil,
 • Apply knowledge to various field conditions.

CE - 09007   Advanced Surveying Laboratory

Teaching Scheme   **Examination Scheme**
Practical: 2 hrs/week   Term-work: 50 Marks
                                                            Practical Examination -
                                                            50 marks

List of Practicals

A) One Second Theodolite
1. Study and use of one second theodolite and measurement of horizontal angle.
2. Setting out a given horizontal angles and measurement of Vertical angles.
3. Finding out elevation of high object by Trigonometrical Leveling.

b) Hydrographic Survey

4. Study and use of Nautical Sextant and measurement of horizontal angles.
5. Solution of 3 point problem by Analytical & Graphical method.

c) Photogrammetry

6. Study and use of Mirror Stereoscope and finding out Air base distance
7. Study and use of Parallax Bar.

d) Total Station

8. Study and use of Total Station and GPS.

e) Project work

Project work shall be conducted in the field outside the institute premises and shall be based on the Adjustment of a Geodetic Quadrilateral / Geodetic Triangle without

central station.

A Laboratory Journal based on the practicals work would be submitted for the term-work. Practical Examination would be based on the term work. Course Teacher for the Laboratory would decide the breakup of marks for the examination and assessment of Termwork.

ML-09001   Constitution Of India

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
20 marks: Continuous evaluation- Assignments /Quiz
End - Sem Exam – 30 Marks

Unit 1   **(5 hrs)**

Preamble to the constitution of India. Fundamental rights under Part – III – details of Exercise of rights, Limitations & Important cases.

Unit 2   **(5 hrs)**
Relevance of Directive principles of State Policy under Part – IV. Fundamental duties & their significance.

Unit 3   **(4 hrs)**

Union Executive – President, Prime Minister, Parliament & the Supreme Court of India.

Unit 4   **(4 hrs)**
State executive – Governors, Chief Minister, State Legislator and High Courts.

Unit 5   **(4 hrs)**
Constitutional Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes. Emergency Provisions.

Unit 6   **(4 hrs)**
Electoral process, Amendment procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments.

Text Books:

1.   Durga Das Basu: "Introduction to the Constitution of India" (Students Edn.) Prentice – Hall EEE, 19th/20th Edn., 2001.
2.   "Engineering Ethics" by Charles E.Haries, Michael. S.Pritchard and Michael J.Robins Thompson Asia, 2003-08-05.

Reference Books:

1. "An Introduction to Constitution of India" by M.V.Pylee, Vikas Publishing, 2002.

Outcomes:

At the end of this course students will be aware about the Constitution:
- Appreciate the complexity of implementation of any law.
- Appreciate the roles and functions of various high officials.
- Know about Fundamental rights of citizens of India.
- Understand the Electoral process.
- Understand the provisions made for special groups and categories in the constitution

CE - 09008   Environmental Engineering

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1   **(6 hrs)**

Air pollution- Definition, sources of air pollution, types and classification of air pollutants, Primary and Secondary air pollutants and their importance, Atmospheric stability, mixing heights, plume types and meteorological parameters.
Effects of air pollution on – Human, Animals, Materials and Vegetation.
Global Effects- Photochemical smog, heat island, ozone depletion, acid rain. Control of air pollution.

Unit 2   **(6 hrs)**

Sources of water, Factors considered in selection of source of water for treatment plant,
Conveyance of raw water-, canals and pipelines, Hydraulics of conduits, Different types of pipes used and their suitability, designing of rising main., intake structure, different types of intake structures.
Quality- Characteristics, Indian standards, Testing of raw water for physical, chemical and bacteriological parameters and their significance.

Unit 3   **(8 hrs)**

Quantity- Population forecasting, different methods of population forecasting, rate of water

consumption for various purposes, factors affecting demand of water, calculation of fire demand.

Water Treatment: Necessity of water treatment processes. Different types of water treatment flow sheets.

Aeration: Principle and Concept, Necessity, Methods,

Unit 4 (8 hrs)

Sedimentation- Theory of sedimentation, types of suspended solids, determination of Settling velocity, Types of sedimentation tanks. Surface Loading, detention time, and design of PST, inlets and outlets arrangements

Theory of chemical coagulation, Factors affecting coagulation, turbidity, rapid mixing, coagulant dosage, characteristics of water, optimum pH, Coagulant aids, choice of coagulants, common coagulants, coagulant aids like Bentonite clay, lime stone, silicates and poly electrolytes,

Rapid mixing-Necessity, gravitational, mechanical, pneumatic devices,

Slow mixing and flocculation, design of flocculation chamber, mean velocity gradient "G" and power consumption,

Concept of Plate settler and Tube settler.

Unit 5 (8 hrs)

Filtration: Theory of filtration, Mechanism of filtration, filter materials, Types of filters- Rapid gravity filter, slow sand-filter and pressure filter. Components, materials, underdrainage system, working and cleaning of filters, operational troubles, Design of filters.

Theory of disinfection- Factors affecting efficiency of disinfection. Types of disinfectants, Mathematical relationship governing disinfections variables. Theory of chlorination, break point chlorination, bleaching powder estimation.

Water softening methods- lime-soda, ion exchange method and Demineralization.

Unit 6 (4 hrs)

System of water supply- Continuous and intermittent system.

Distribution of water- Different distribution systems and their components, layouts, Methods of supply like gravity, pumping and combination, Design of distribution system, determination of Balancing Capacity of ESR

Text Books
- H. V. N. Rao and M. N. Rao, "Air Pollution", TMH Publications.
- S. K. Garg ,"Water Supply Engg.", Khanna Publishers - NewDelhi.
- Peavy and Rowe, "Environmental Engg.", McGraw Hill Publications

Reference Books
- Stern,"Air Pollution Vol. I – IV", McGraw Hill.
- Sharma and Kaur, "Environmental Chemistry", Goyal Publisher.
- Water Supply and Treatment Manual: Govt. Of India Publication.
- Fair and Geyr, "Environmental Engineering", McGraw Hill Publications.
- Steel and McGhee, "Environmental Engineering", McGraw Hill Publications.

Outcomes:
Basic concepts of design of water treatment plant taught are assessed through various assignments on different numerical design problems. The characteristics of water are tested in the laboratory where the students are required to perform various laboratory experiments and compare results with standards specified by IS 10500 and decide suitability of water for various types of consumption. The students are asked to solve some assignments based on theory and laboratory courses to assess their understanding of skill to design various water treatment units.

CE - 09009   Construction Management

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1   (7 hrs)

Time Management, Introduction, steps in Project Management – work break down structure,
Bar Chart, Mile stone chart, Gantt Chart, Activity On Arrow and Activity On node
Introduction to PERT: Concept of probability, normal and Beta Distribution, Central limit theorem. Time estimates and calculations of project duration, critical path, slack, probability of project completion

Unit 2   (7 hrs)

Precedence network, CPM : Introduction, Time estimates, floats, critical path, Network compression – Least Cost and optimum duration, Updating of networks– needs, steps, project duration, calculation for updated network

Unit 3   (7 hrs)

Resource Management, Men- Resource allocation – smoothening and leveling,
Material Management- definition by international federation of purchasing and material management. Objectives, Role Functions, Qualities of material manager Material forecasting.
Inventory Control- Necessity, Techniques such as ABC, EOQ, HML, VED, SDE, etc. MUSIC-3d role, lead-time, safety stocks, Material Evaluation using differential indices

Unit 4   (7 hrs)

Financial Management
Introduction to Engineering economics, importance, demand and supply, types of costs, interest – simple, compound, continuous, effective

Value of Money – time and equivalence, tangible and intangible factors, introduction to inflation. Interest factors – Uniform series factors – derivations.

Unit 5 (7 hrs)

Economic comparisons, Discontinuing methods : Present worth method, equivalent annual cost method, capitalized cost method, net present value, internal rate of return

Unit 6 (5 hrs)

Site layout, Factors affecting, Typical layout few major construction projects, Safety Engineering, Accident cost, IFR, ISR, injury sources and causes, Effective safety programmes occupational health hazards, Personal protective equipment, Preparation of safety programmes for construction works

Text Books
- B. Sengupta, "Construction Management and Planning", Tata McGraw Hill Publication
- Barrie Paulsion, "Professional Construction Management", McGraw Hill Institution Edition
- Srinath L.S. "*PERT & CPM* : Principles and Applications", Affiliated East West Press, Delhi
- B.C.Punmia, "Project Planning and Control with PERT and CPM", Laxmi Publications (P) Ltd.

Reference Book
- Jha K. N. "Construction Project Management" Pearsons publication.
- S. Seetharaman, "Construction Engineering and Management", Umesh Publications
- K.S. Menon ,"Purchasing And Inventory Control", A. H. Wheeler Publishing Company Limited
- Gopalkrishnan and Sundaresan," Materials Management: An Integrated Approach", PHI Learning Pvt. Ltd.
- L.C. Jhamb,"Inventory management", Everest Pub. House, Pune , 1987
- M. K. Rustogi,"Production and Operation Management",University Science Press.
- Roy Pilcher,"Principles of Construction Management", McGraw-Hill Book Co.,1982

Outcome:
The students get the feel of Fundamentals of Construction Management from the first and second Units of the subject. They gradually become familiar with various kinds of topics like Bar Chart, Mile Stone Chart etc. After that they become able enough to solve the small networks manually without the help of computers. After that they get the complete knowledge of Network Analysis and Economics involved in the subject of Construction Management. Apart from that focus is made on safety aspects in Construction Management. Students are given various assignments to solve different kinds of problems.

CE - 09010   Hydrology and Irrigation Engineering

Teaching Scheme
Lectures : 3 hrs/week
Tutorial : ----

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1   (7 hrs)

Precipitation :
 Introduction to Hydrology, Hydrological cycle and application of hydrology. Precipitation, Types of Precipitation, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves, and concept of depth area duration analysis, frequency analysis. Elementary concepts of evaporation, transpiration, evapotranspiration and infiltration.

Unit 2   (7 hrs)

Stream flow measurements:
Selection of site, various methods of discharge measurements, Runoff- Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph theory, S-curve hydrograph, synthetic unit hydrograph, use of unit hydrograph
Floods- Estimation of peak flow, rational formula and other methods, flood frequency analysis, Gumbells method, Design floods

Unit 3   (7 hrs)

Irrigation :
 Definition, functions, advantages and necessity. Water requirement of crops, Soil classification, soil moisture and crop water relationship, factors governing consumptive use of water, principal Indian crops, their season and water requirement, agriculture practices. Cropping pattern, calculations of canal capacities

Unit 4   (7 hrs)

Reservoir planning :
Types of developments: Storage and diversion works Purpose : Single and multipurpose, Investigation for locating reservoir, selection of site, dependability calculations, estimation of required storage, mass curves, reservoir sedimentation, flood routing, height of dam , reservoir operation, economics of reservoir planning, Benefit-cost ratio

Unit 5   (7 hrs)

Ground water hydrology :
Occurrence and distribution of ground water, specific yield of aquifers, movements of ground water, Darcy's law, permeability, safe yield of basin. Hydraulics of well under steady flow condition in confined and unconfined aquifers, specific capacity of a well, well irrigation: tube

wells, open wells

Unit 6 (5 hrs)

Water logging and drainage:
Causes of water logging, preventive and curative measures, drainage of irrigation of lands, reclamation of water logged, alkaline and saline lands.
Lift irrigation schemes - Various components and their design principles (Only concepts)
Application of water- Water management and distribution, warabandi, rotational application. Various Methods of Assessment of canal revenue

Text Books

- K.Subramanya, "Engineering hydrology", Tata McGraw Hill (3rd Edition)
- Garg, S.K., "Irrigation Engineering and Hydraulic Structures", Khanna Publications (2009)
- P. N. Modi, "Irrigation, water resources and water power Engineering", Standard book House (2008)
- G.S. Birdie & Das, "Irrigation Engineering", Dhanpat Rai Publishing Company (P) Ltd.

Reference Book

- Dilip Kumar Majumdar, "Irrigation Water Management (Principles & Practices)", Prentice Hall of India (P), Ltd (2000).
- Basak, N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co (1999)
- Asawa, G.L., "Irrigation Engineering", New Age International Publishers (2nd Edition)

Outcomes:
At the end of this course students will be able to
- understand the features of the primary hydrological processes.
- Determination of average rainfall, runoff, evaporation loss and other losses from a reservoir/watershed.
- Understand various terms related to irrigation engineering
- Determine crop water requirement, reservoir capacity and canal capacity, and capacity of well.

CE - 09011   Foundation Engineering

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1   (6 hrs)

Soil Exploration:
Purpose, importance, methods of soil exploration, subsurface exploration, trial pits, boring: method of borings. Number of boreholes, depth and spacing of boreholes, types of test to suit the soil conditions, Location of water table, Sampling: Disturbed And Undisturbed Samples, Field tests: SPT, DCPT, SCPT, pressure-meter test, plate load test, field vane shear test

Unit 2   (6 hrs)

Introduction to Foundation Engineering:
Functions of substructure, Common Types of foundations viz. shallow and deep foundations, isolated and combined footings, raft, pile, well foundations. suitability and applications. Minimum depth of footing.

Unit 3   (8 hrs)
Bearing Capacity of Shallow Foundation:
Terzaghi's bearing capacity analysis, Meyerhoff, Hansen's and Vasic equations for strip, rectangular and round footing, effect of various BC factor on bearing capacity, Use of field test (SPT and Plate Load) data for bearing capacity determination, bearing capacity of rocks, RQD concept,

Unit 4   (8 hrs)

Settlement of Shallow Foundation:
consolidation, spring analogy, Terzaghi's theory of one dimensional consolidation, Lab consolidation test, determination of consolidation parameters viz. c_c c_v , m_v and a_v. Square root and logarithm of time fitting method. Rate of settlement, normally and over consolidated soils, Determination of pre consolidation pressure, Evaluation of consolidation settlement, elastic settlement.

Unit 5   (6hrs)

Design of Shallow Foundation:
Geotechnical design of isolated and raft foundation, shear failure and settlement criteria

Unit 6 (6 hrs)

Pile and deep Foundation:
Pile classification, Carrying capacity of pile, static and dynamic methods, pile load test, group action, Rigid block method, Negative skin friction, Settlement of single and group of piles, introduction to well foundation

Text Books

- Dr. B. J. Kasmalkar, "Foundation Engineering", Pune Vidyarthi Griha Prakashan, Pune.
- Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, (2010).
- B.C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publication.
- A.K.Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers, 2009.

Reference Books

- J. E. Bowles, "Foundation Analysis and Design", McGraw-Hill International.
- B. M. Dass, "Foundation Engineering", Cengage Learning; 7 edition
- N.V. Nayak, "Foundation Design Manual", Dhanpat Rai and Sons,First Edition.

Outcomes:
This course used assigned readings, lectures, and homework to enable the students to:
  (i) Use engineering science principles to develop foundation engineering knowledge.
  (ii) Understand and apply various soil strata, types of foundations and evaluation of bearing Capacity of different foundations in the field.

CE - 09012   Design of RCC Structures

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1 (07 hrs)

Design philosophies of R.C structures (WSM, LSM), Structural elements, loads on structures, and structural properties of concrete, Role of structural engineer.
R.C. sections in flexure, theory & analysis, singly, doubly reinforced rectangular and flanged sections**.**

Unit 2 (07 hrs)

One-way and two slabs - simply supported, cantilever and continuous.
Design of staircase: Dog legged and open well.

Unit 3   **(07 hrs)**

Design of beams for flexure, shear, bond and torsion: Simply supported, continuous redistribution , cantilever

Unit 4   **(07 hrs)**

Design of Column, axially loaded, short & long, uniaxial & biaxial moments.

Unit 5   **(07 hrs)**

Isolated column footing, axial load, uni-axial and biaxial moments. Eccentric footing. Footing in difficult soil conditions

Unit 6   **(07 hrs)**

Concept of building frame design, Design of cantilever Retaining wall.

Text Books
- Punmia, Jain and Jain,"Comprehensive Design of R.C. Structures", Laxmi Publications.
- Dr. V. L. Shah and Dr. S.R. Karve," Limit State Theory and Design", Pune Vidyarthi Publication.

Reference Books
- P. Dayaratnram, "Limit State Analysis and Design" Oxford and IBH, New Delhi.
- Sinha, "RCC Analysis and Design Vol. II and I", S. Chand and Co. New Delhi.

Outcomes:
After learning this course students will be able to
- Understand the use of I S Codes related to RCC design of structures.
- Design various components of a RCC structure like beams, columns, slabs, footings and cantilever retaining wall as per limit state method of design.
- Prepare detailed structural drawings of a RCC structure.

CE - 09013   Design of Steel Structures Lab

Teaching Scheme   **Examination Scheme**
Practical: 2 hrs/week   Term-work: 50 Marks
                                                         Oral: 50 Marks

The laboratory work should include the following:
   A. Design of any ONE structure as per IS 800- 2007

       1. G+1 Industrial building with roof supported by steel trusses.
       2. Pedestrian bridge
       3. Design of Pre Engineered Building

   B. Design of continuous beams using plastic analysis as per SP:6

       The Report should include
              1. Brief Technical design project report involving
                 Introduction, assumptions, load calculations, analysis, preferably using suitable
                 software and detailed design.
              2. Drawings
                 Structural plan and detailed structural drawings
              3. Report of a site visit mentioning structural details with relevant sketches of
                 structural connections.

Outcomes:
After learning this course students will be able to
   • Design the various components of a steel structure like beams, columns, axial force
     members in a truss and their bolted and welded connections as per relevant I S Codes
   • Prepare detailed structural drawings of the various components designed as per relevant
     I S Codes

CE - 09014   Environmental Engineering Laboratory

Teaching Scheme   **Examination Scheme**
Practical: 2 hrs/week   Term-work: 50 Marks
                                                         Oral: 50 Marks

List of Practicals:

   (A) Determination of (Any Eight)
          1. pH and Alkalinity
          2. Hardness

3. Chlorides
4. Chlorine demand and residual chlorine
5. Turbidity and optimum dose of alum.   ,
6. MPN
7. Sulphates
8. Fluorides
9. Iron

B) Site visit to water treatment plant.
A report based on the visit to water treatment plant would be submitted and would form a part of the term work.

C) Design of various components of water treatment plant
Design of various components of water treatment plant would be carried out based on the theory covered in CE- 301 Environmental Engineering-I.

OR

C) Study of Software or programming for analysis of water distribution system
Programmes available for the design of various water treatment plants would be used or Computer Programmes to Design various units of water treatment plant would be written in any suitable programming language.

OR

C) At least six assignments on the over all syllabus

Note: The term work shall consist of record of above Practical Journal B and   D
Oral /Practical examination will be based on above exercises
Outcomes:

- Students will be able to know basic concepts of determination of various parameters
- Students will be able to determine various laboratory experiments and compare results with standards specified by I S 10500 and decide suitability of water for various types of consumption.
- Students will be able to complete some assignments based on theory and laboratory courses to assess their understanding of skill to design various water treatment units

CE - 09015   Construction Management Laboratory

Teaching Scheme   **Examination Scheme**
Practical: 2 hrs/week   Term-work: 50 Marks
                                                             Oral: 50 Marks

Term work shall be based on the following:

a) **Term Work Based on Course Work**
- Theories of Management
- Functions of management
- Time Management
- Resource Management

- Financial Management
- Site Layout
- One assignment in MSP / PRIMAVERA / Any construction Management software.
- Inventory Control- Necessity, Techniques such as ABC, EOQ, HML, VED, SDE

b) **Site Visit to Project Site**
- A report would be presented as a part of course work and shall form the part of term work. Course Teacher will arrange all the visits to suit the course work.

A Laboratory Journal based on the practical work would be submitted for the term-work. Oral Examination would be based on the term work. Course Teacher for the Laboratory would decide the breakup of marks for the Oral Examination. An Objective Multiple Choice Test based on the theory for the Course Work can be conducted as a part of the oral examination.

Outcomes:

- Students will be able to determine the practical application of construction management.
- Students will be able to determine the time duration, material requirement, manpower requirement of construction project.
- Students will be able to perform feasible economic analysis of different projects and can choose feasible project.
- Students will be able to understand safety of worker, MIS in the construction organization.

AS-09002   Humanities course/Applied Psychology

Teaching Scheme
Lectures : 4 hrs/week
Practical : 2hrs/week

Examination Scheme
100 marks:
Assignments /Practical(T1 and T2)- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1   **(4 hrs)**

Introduction to Psychology:
Definition, Nature and Aims, Counseling, Industrial and Social Psychology, Creativity and its application.
Mind Mapping and Problem Solving, Self Awareness, Johari window.

Unit 2   **(6 hrs)**

Personality:
Carl Jung's type theory, Bandura's Social learning, Big Five model Indian Perspective on Personality- Panchakosh Model, SWOT analysis, life planning, emotional intelligence.

Unit 3   **(8 hrs)**

Organizational Behaviour:
Behaviour at workplace (personality, attitude and perceptions), Motivation, Job satisfaction, Leadership and Group dynamics, Engineering Psychology (Ergonomics), Man-machine relation, Group dynamics, Transactional analysis

Unit 4   **(4 hrs)**

Stress Management:
Nature, types and causes of stress, General Adaptation Syndrome (GAS), Coping with Stress- Cognitive, Emotional, and Behavioural techniques, Type A and B theory.

Text Books
1. Morgan, C.T., King, R.A., Weisz, J.R., & Schopler, J. (2001). *Introduction to Psychology*. 7th Edition. New Delhi: Tata McGraw Hill
2. Schultz, D. & Schultz, S. E. (2002). *Psychology and Work Today*. 8th Edition. Pearson Education

Reference Book
1. Hilgard, E. R., Atkinson, R. C., Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
2. Golman, Daniel. (1998). *Working with Emotional Intelligence*. Bloomsbury Publishing Plc.
3. Matthewman, L., Rose, A., & Hetherington, A. (2009). *Work Psychology*. Indian Edition. Oxford University Press

Practical Work

Teaching Scheme   **Examination Scheme**
Practical: 2 hrs/week   Term-work: 50 Marks
                                              Oral: 50 Marks

List of Experiments:

1: Self Awareness (20 Marks)   **(4 hrs)**

Aims/Objectives for the Year- Newspaper Activity, SWOT analysis, Personal Effectiveness Scale, Johari Window.

2: **Level of Adjustment (10 Marks)**   **(6 hrs)**

Adjustment Inventory By M.L. Saxena, Interpretation and Explanation

3: Stress and Personality (15 Mark)   **(8 hrs)**

Student's Stress Scale by Dr. Manju Agrawal, Type A- B theory and test, Interpretation and Explanation

4:Emotional Quotient (5 Mark)   **(4 hrs)**

Concept of EQ, EQ test by N.K.Chadha, Interpretation and Explanation

Outcomes:
After successful completion of the course students will be able-
1. To understand different aspects of their personality and to learn various life skills
2. To strengthen the skills required in industrial/workplace settings
3. To overcome stressful situations effectively with the help of psychological approach
4. To improve their social interactions.

Annexure I

List of Open Elective/Professional Science courses offered by ALL Departments

Sr. No	Department	Course
1	Civil	Finite Elements in Engineering
2	Mechanical	1. Unconventional Machining Processes 2. Modern Control Systems 3. Power Plant Engineering
3	Electrical	1. Industrial Drives 2. Control System Engineering
4	Electronics and Telecommunication	Electronic Communication Systems
5	Metallurgy and Material Science	Composite Materials
6	Instrumentation and Control	Industrial Automation
7	Production	1. Introduction to ERP 2. Operations Efficiency
8	Computer Engineering	Information Systems
9	Information Technology	Information Systems
10	Applied Science	1. Humanities Course 2. Constitution of India
11	Innovation Centre	Liberal Learning Course

Annexure II

List of Liberal Learning courses offered at Institute Level

- **Agricultural** – Animal Science, Forestry, Horticulture, Floriculture, Sustainable Agriculture, Veterinary

- **Arts** – Graphic Design, Interior Design, Fashion Design

- **Basic Sciences** – Astronomy, Astro- Physics, Biology, Genetics, Kinesiology, Microbiology, Neuro Sciences.

- **Business** – Administration, Communication, Entrepreneurial studies, Hostel Management, Marketing.

- **Defense Studies** - Military Studies, Naval Studies, Air Force Studies, War strategies.

- **Education** - Education policies, Engineering Education, Teacher Training.

- **Environmental Sciences** – Ecology, Meteorology

- **Linguistics** – Word Language

- **Medicine** – Health Studies Nutrition and dietetics

- **Performing Arts**- Music, Dance Theatre, Cinema

- **Philosophy**- Religious Studies

- **Sports and Athletics**