M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION
B.TECH. (CIVIL ENGINEERING)
SEMESTER 3rd and 4th
Scheme effective from 2019-20

COURSE CODE ANDDEFINITIONS

Course Code	Definition
L	Lecture
T	Tutorial
P	Practical
BSC	Basic ScienceCourses
ESC	EngineeringScienceCourses
HSMC	Humanities and Social Sciences includingManagementcourses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION
Bachelor of Technology (Civil Engineering) Scheme effective from 2019-20
SEMESTER 3rd

Sr. No.	Course Code	Course Title	Hours per week L-T-P	Contact hours per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
						Class work	Theory	Practical	Total	
1.	HSMC-201-G	Economics For Engineers	2-0-0	2	2	25	75	-	100	3
2.	PCC-201-G	Introduction to Civil Engineering	2-0-0	2	2	25	75	-	100	3
3.	BSC-Math-205-G	Mathematics III	2-1-0	3	3	25	75	-	100	3
4.	PCC-203-G	Engineering Mechanics	3-1-0	4	4	25	75	-	100	3
5.	*MC-106-G	Environmental Science	3-0-1	4	0	25	75	-	--	3
6.	PCC-CE-205-G	Fluid Mechanics	2-1-0	3	3	25	75	-	100	3
7.	PCC-CE-207-G	Surveying	2-1-0	3	3	25	75	-	100	3
8.	LC-CE-209-G	Building Drawing lab	0-0-2	2	1	25	-	25	50	3
9.	LC-CE-211-G	Engineering Mechanics Lab.	0-0-2	2	1	25	-	25	50	3
10.	LC-CE-213-G	Fluid Mechanics Lab.	0-0-2	2	1	25	-	25	50	3
11.	LC-CE-215-G	Surveying Lab.	0-0-2	2	1	25	-	25	50	3
				TOTAL	**21**					

MC-106G is a mandatory non –credit course in which the students will be required passing marks in theory.

Course Name	:	ECONOMICS FOR ENGINEERS	
Course Code	:	HSMC-201-G	External marks: 75
Credits	:	2	Internal marks: 25
L-T-P	:	2-0-0	Total marks: 100

Course Objectives:

1. Acquaint the students to basic concepts of economics and their operational significance.
2. To stimulate the students to think systematically and objectively about contemporary economic problems

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

<div align="center">SYLLABUS</div>

UNIT-1
Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, **Elasticity of Demand-** meaning, factors effecting it, its practical application and importance.

UNIT-2

Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale.

Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-3
Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT-4

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), **Privatization -** meaning, merits and demerits.

Globalization of Indian economy - merits and demerits.
Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions, Difference between Commercial & Central Bank.

Course Outcomes: By the end of this course the student will be able to:
1. The students will able to understand the basic concept of economics.
2. The student will able to understand the concept of production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and
5. banks.

Suggested Books:

1. Jain T.R., Economics for Engineers, VK Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory – M.L. Jhingan (S.Chand).
10. Micro Economic Theory - H.L. Ahuja (S.Chand).
11. Modern Micro Economics : S.K. Mishra (Pragati Publications).
12. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co).

INTRODUCTION TO CIVIL ENGINEERING			
Course Code	PCC-201-G	External marks:	75
Credits	2	Internal marks:	25
L-T-P	2-0-0	Total marks:	100
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:
- To provide the students an overview of the profession of Civil Engineering.
- To give the students an illustration of the Civil Engineering, properties of various building material, basic requirements of a building and explain the building construction aspects.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION-A

Module 1: Civil Engineering and Society
Basics of Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Early constructions and developments over time; Ancient monuments & Modern marvels, Works of Eminent civil engineers, Impact (social, economic, environmental) of Civil Engineering on Society, Introduction to green building concept and methods, Job opportunities in Civil Engineering.

Module 2: Masonry Construction
Introduction, Various terms used in brick masonry, classification of bricks, composition, bonds in brick work, laying brick work, structural brick work, reinforced brick work, Defects in brick masonry, Stone masonry and its classification, composite masonry, Glass block masonry.

SECTION-B

Module 3: Stones and Tiles
Stones: Classification, requirements of good structural stone, quarrying, blasting, dressing of stones, prevention and seasoning of stone; **Tiles:** Manufacturing of tiles, Terra-cotta and its types, uses of terracotta.

Module 4: Timber, paints and varnishes
Classification of timber, structure of timber, seasoning of timber, defects in timber, fire proofing of timber, advantages of plywood and fiber boards, Important Indian timbers; Basic constituents of paints, types of paints, constituents of varnishes, characteristics and types of varnishes.

SECTION-C

Module 5: Roofs and Floors

Types of roofs, various terms used, roof trusses-king post truss, queen post truss etc. Floor structures, ground, basement and upper floors, various types of floorings. Doors and Windows: Locations, sizes, types of doors and windows, fixtures and fasteners for doors and windows.

Module 6: Cavity, Partition Walls and Foundations

Cavity walls and its position, advantages of cavity wall, types of non-bearing partitions, constructional details and precautions, construction of masonry cavity wall. Types of foundations, sub-surface investigation, Foundation in water logged areas, Masonry wall foundation, Introduction to deep foundations.

SECTION-D

Module 7: Damp-Proofing, Water-Proofing and Fire protection

Dampness and its causes, prevention of dampness, materials used, amp-proofing treatment in buildings; Water proofing: water- proofing treatment of roofs; Fire protection: Fire resisting construction, fire protection requirements for buildings.

Module 8: Sound insulation and Acoustics

Classification, measurement and transmission of sound, sound insulation of buildings, Acoustical materials and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses.

COURSE OUTCOMES:
At the end of the course, the students will be able to
- Explain the importance of Civil Engineering in the infrastructural development of the society.
- They will be able to illustrate the types and properties of various building materials.
- To be aware of various traditional building materials and also the emerging materials in the field of Civil Engineering construction.
- To select suitable type of flooring, Plastering, varnishes with their application.
- They should be able to describe the basic requirements to construct a building.

Suggested Books:
- Building Construction By Sushil Kumar, Standard Pub., N. Delhi
- Building Material By Rangawala
- Construction Engineering By Y.S. Sane
- Building Construction By Gurcharan Singh, Standard Pub., N. Delhi

Course Name	:	Mathematics III	
Course Code	:	BSC-MATH-205-G	External marks: 75
Credits	:	3	Internal marks: 25
L-T-P	:	2-1-0	Total marks: 100
Course Objectives:			

Course Objectives:
At the end of this course, the student should be able to learn the behaviour of civil engineering determinate structures under static and moving loads by analytical/experimental techniques and software tools. The student should also be able to acquire the ability to interpret and evaluate experimental results.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

SYLLABUS

Unit-I
Partial Differential equations: First order linear partial differential equations, First order non-linear partial differential equations, Charpit's method, Second order linear partial differential equations and their classifications, Method of separation of variables and its applications to wave equation, One dimensional heat equations and Two dimensional heat flow (steady state solutions only)

Unit-II
Numerical methods: Solution of Polynomial and Transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules

Unit-III
Transform Calculus: Laplace Transform, Properties of Laplace transform, Laplace transform of periodic functions, Inverse Laplace transform by different methods, Convolution theorem, Evaluation of integrals by Laplace transform, Solving ordinary differential equations by Laplace transform method

Unit-IV
Discrete Maths: Pigeon-hole principle, Permutation, Combination, Algebraic structures with one binary operation- Semi group, Monoid and Group, Cosets, Lagrange's theorem, Cyclic group, Normal subgroup

Course Outcomes: By the end of this course the student will be able to:
1. To solve field problems in engineering involving partial differential equations
2. To find roots of polynomial and transcendental equations using numerical methods and conduct numerical integration
3. To deal with the Laplace transform and its application
4. To classify algebraic structure of any mathematical problem.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
4. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand and Company
5. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI.
6. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
7. C. L. Liu, Elements of Discrete Mathematics, Tata McGraw-Hill.
8. K. H. Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill.
9. J. L. Hein, Discrete Structures, Logic and Computability, Jones and Bartlett.

ENGINEERING MECHANICS			
Course Code	PCC-203-G	External marks:	75
Credits	4	Internal marks:	25
L-T-P	3-1-0	Total marks:	100
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:

- Students should be able to identify and analyse the basic structural elements.
- Students can apply the concepts of analysis for the design of various civil engineering structures.
- Covers the relationship between stress and strain on deformable solids, principal stresses, maximum shearing stress, and the stresses acting on a structural member.
- To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION-A

Module 1: Simple Stresses and Strains
Properties of Materials, i.e. tensile test, idealized stress- strain diagrams, isotropic, linear, elastic, Visco- elastic and plastic materials, Concept of stresses and strains, St.Venant's principle, relationship between elastic constants, Poisson's Ratio, Hoop stress, Stress and extension of uniform bar and tapered bar under its own weight and due to load, stresses produced in compound bars due to axial loads, Factor of Safety, Thermal stress and strain calculations, Shear stresses and shear strain, Complementary shear stress.

Module 2: Compound stress and strains
Normal stress, tangential Stresses, Stresses induced due to Uniaxial loads, stresses induced by state of simple shear, stresses induced due to biaxial loads, Mohr's Circle (Graphical Method), Principal stresses and principal planes, Maximum shear stresses, Proof stress.

SECTION-B
Module 3: Shear Force and Bending Moment in Beams and Frames
Type of loads, Shear force and bending moment, relation between Shear force and bending moment, Definition and Sign conventions, axial force, Shear force and Bending moment diagrams

Module 4: Bending stresses and Shear stresses in Beam
Pure bending, bending stresses, combined bending and direct stresses, Middle Third rule, composite beams, Variation of shear stresses for various cross-sections of a beam.

SECTION-C

Module 5: Torsion and Thin Cylinder

Torsion equation, its applications to the hollow and solid circular shafts, comparison of solid and hollow Shafts, shafts in series and parallel. Combined torsion and bending of circular shafts. Introduction to thin cylinder, Stresses in thin cylinder vessels subjected to internal pressure Circumferential stresses (Hoop Stresses), longitudinal stress.

Module 6: Column and Strut

Criteria for stability of columns, Buckling of columns, Euler's formula for various end restraints, Rankine's formula, eccentrically loaded struts, struts with initial curvature, struts with lateral loading.

SECTION-D

Module 7: Analysis of Plane Trusses

Different types of trusses, Analysis of plane determinate trusses by method of joints, method of sections and analysis of Space Trusses using Tension Coefficient Method.

Module 8: Failure Theories

Theories of failure: maximum principal stress theory, maximum principal strain theory, maximum shear stress theory, maximum strain energy theory, distortion energy theory, comparison of the failure theories.

Course Outcomes:

At the end of the course, the students will be able to
- Identify different materials and their behaviour.
- Analyse various civil engineering structures under different loading conditions.
- Apply the principles of structural mechanics in design structural elements.
- Apply the concepts of failure theories for design of structures.

Suggested Books:
- Strength of Material by G.H. Ryder, MacMillan Publishers India Ltd.
- Mechanics of Materials by E.J. Hearn, Elsevier Publications.
- Mechanics of Materials by Punmia and Jain, Laxmi Publications (P) Ltd.
- Mechanics of Materials by R.C.Hibbeler, Pearson Higher Education.
- Strength of Materials by Timoshenko and Young,, East West Press.
- Mechanics of materials by V Gupta, Narosa publishing house.

ENVIRONMENTAL SCIENCE, *MC-106-G

Objective: To provide the basic knowledge in Environmental Sciences to students of Engineering. It will guide the students living in a historic transitional period of burgeoning awareness of the conflict between human activities and environmental constraints to help and save the fragile and endangered planet with the natural resources already overexploited.

Course code: MC-GES-106-G

Environmental Studies (Semester 1)							
Lecture	Tutorial	Practical/Field visit	Credit	Theory	Field visit	Total	Time
3	0	1	-	75	25	-	3Hrs

MC-ENV : (ENVIRONMENTAL SCIENCE)

Theory   75 Marks   Field Work 25 Marks (Practical/Field visit)

Unit-1 The Multidisciplinary nature of environmental studies. Definition, scope and importance.   (2 lecture)

Unit-2 Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.

* Equitable use of resources for sustainable lifestyles.

Unit-3 Ecosystems :
* Producers, consumers and decomposers.
* Energy flow in the ecosystem.
* Ecological succession.
* Food chains, food webs and ecological pyramids.
* Introduction, types, characteristic features, structure and function of the following eco-system :
a. Forest ecosystem.
b. Grassland ecosystem. c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
(6 lectures)

Unit-4 Biodiversity and its conservation
* Introduction - Definition : Genetic, Species and ecosystem diversity.
* Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
* Biodiversity at global, National and local levels.
* India as a mega-diversity nation.
* Hot-spots of biodiversity.
* Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
* Endangered and endemic species of India.
* Conservation of biodiversity : In-situ and ex-situ conservation of biodiversity.

(8 lectures)

Unit-5 Environmental pollution :
Definition, causes, effects and control measures of :
a) Air pollution.
b) Water pollution c) Soil pollution
d) Marine pollution e) Noise pollution
f) Thermal pollution g) Nuclear hazards
* Solids waste management: causes, effects and control measures of urban and industrial wastes.
* Role of an individual in prevention of pollution.
* Pollution case studies.
* Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

Unit-6 Social issues and the Environment:
• From unsustainable to sustainable development.

- Urban problems related to energy.
- Water conservation, rain water harvesting, watershed management.
- Resettlement and rehabilitation of people : its problems and concerns case studies.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of pollution) Act.
- Water (Prevention and Control of pollution) Act.
- Wildlife Protection Act.
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- * Public awareness.   (7 lectures)

Unit-7   Human population and the Environment.

Population growth, variation among nations. Population explosion- Family Welfare

Programme. Environment and human health.

Human Rights. Value Education. HIV/AIDS.

Woman and Child Welfare

Role of Information Technology in Environment and human health.

Case Studies.   (6 lectures)

Unit-8   Field Work :
   * Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain.
   * Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural.
   * Study of common plants, insects, birds.
   * Study of simple ecosystems- pond, river, hill slopes, etc. (Field work equal to 10 lecture hours).

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd. Bikaner.

2. Bharucha, Frach, The Biodiversity of India, MApin Publishing Pvt. Ltd. Ahmedabad-380013, India, E-mail : mapin@icenet.net (R).

3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.

4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).

5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai 1196 p.

6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.

7. Down to Earth, Centre for Science and Environment (R).

8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.

9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).

10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge Uni. Press 1140p.

11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.

12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.

13. Mhaskar A.K., Mayyer Hazardous, Tekchno-Science Publications (TB).

14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB).

15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.

16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford & TBH Publ. Co. Pvt. Ltd. 345p.

17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ. House, Meerut.

18. Survey of the Environment, The Hindu (M).

19. Townsend C., Harper J. and Michael Begon. Essentials of Ecology, Blackwell Science (TB).

20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).

21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno Science Publications (TR).

22. Wagner K.D., 1998, Environmental Management, W.B. Saunders co. Philadelphia, USA 499p.

23. A text book environmental education G.V.S. Publishers by Dr. J.P. Yadav.

(M)   Magazine   (R)   Reference   (TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory : 75 marks, Practical/ Field visit : 25 marks.
The structure of the question paper will be :

Part- A : Short Answer Pattern   :   15 marks
Part- B : Essay Type with inbuilt choice   :   60 marks
Part-C : Field Work (Practical)   :   25 marks

Instructions for Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

Fluid Mechanics			
Course Code	PCC-CE-205-G	External marks:	75
Credits	3	Internal marks:	25
L-T-P	2-1-0	Total marks:	100
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:

- Introduce the concepts of fluid mechanics useful in Civil Engineering applications.
- To provide the students a first level exposure related to fluid statics, kinematics and dynamics.
- To provide the knowledge for measurement of pressure, computations of hydrostatic forces on structural components, concepts of Buoyancy and their applications in many engineering problems.
- Topics included in this course are aimed to prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology in later semesters.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION A
Module 1: Basic Concepts and Definitions
Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, cavitations; surface tension, capillarity, Bulk modulus of elasticity, compressibility, types of fluids

SECTION B
Module 2: Fluid Statics
Fluid Pressure: Pressure density height relationship, pressure at a point, Pascal's law, gauge and absolute pressure, Pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, pressure gauges,

Module 3: Hydrostatic pressure and force
Hydrostatic pressure and force: horizontal, vertical and inclined surfaces, centre of pressure. Buoyancy and stability of floating bodies, metacentric height

SECTION C
Module 4: Fluid Kinematics
Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; rotation and circulation; Stream line, path line, streak line and stream tube; stream function, velocity

potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

Module 5: Fluid Dynamics
Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; limitations of Bernoulli's equation, Practical applications of Bernoulli's equation: Venturimeter, Orifice meter and Pitot tube

SECTION D
Module 6: Boundary Layer Analysis
Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries, Local and average friction coefficients Separation and Control.

Module 7: Dimensional Analysis and Hydraulic Similitude
Dimensional analysis, Buckingham theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modelling, similar and distorted models.

COURSE OUTCOMES:
- Understand the broad principles of fluid statics, kinematics and dynamics
- Understand definitions of the basic terms used in fluid mechanics
- Understand classifications of fluid flow
- Be able to apply the continuity, momentum and energy principles
- Be able to apply dimensional analysis

SUGGESTED BOOKS:

- Hydraulic and Fluid Mechanic by P.N.Modi & S.M.Seth
- Introduction to Fluid Mechanics by Robert W.Fox & Alan T.McDonald 3 Fluid Mechanics Through Problems by R.J.Garde
- Engineering Fluid Mechanics by R.J.Garde & A.G.Mirajgaoker
- Fluid Mechanic and Hydraulic machines R.K. BANSAL

Surveying			
Course Code	PCC-CE-207-G	External marks:	75
Credits	3	Internal marks:	25
L-T-P	2-1-0	Total marks:	100
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:

- To understand the importance of surveying in Civil engineering.
- To study the basics of linear, angular and direction measurements using chain/tape, theodolite and compass.
- To study the method of determination of height of points using various levelling method and tacheometer.
- To study the significance of Plane Table surveying in preparation of map and setting of different types of curves.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION A

Module 1: Basics of Surveying and Linear measurement

Definition, principles of surveying, objectives and classifications, Instruments used for measuring distance, chaining, errors in chaining, tape corrections and examples, concept of Geoids and reference spheroids.

Module 2: Direction Measurement

Types of compass- prismatic and surveyor's compass, Bearings and meridians, declination, local attraction, errors and adjustments, Methods of compass traversing, checks in traversing, adjustment of closed traverse and examples.

SECTION B

Module 3: Levelling

Terms used in levelling, types of levels and staff, principles of levelling, temporary adjustments of levels, reduction of levels and booking of staff readings, examples.

Module 4: Geodetic Trigonometric levelling

Height and distances- base of the object accessible and inaccessible, geodetical observation, correction due to curvature and refraction, axis signal correction, difference in elevation between two points.

SECTION C

Module 5: Plane Table Surveying

Plane table accessories, methods of plane table surveying, sources of error, advantages and disadvantages of plane table surveying; contouring and characteristics of contour lines, locating contours, interpolation of contours, contour maps.

Module 6: Angle Measurement

Theodolite, parts of theodolite, Temporary adjustment of Theodolite, measurement of horizontal and vertical angles by different methods, theodolite traversing, adjustments of closed traverse.

SECTION D

Module 7: Tachometric surveying

Principle of of tacheometric surveying, different instrument used in tacheometry, stadia and tangential method of tacheometry, tacheometric constants and their determinations, examples.

Module 8: Curves

Classification of curves, elements of simple circular curve, location of tangent points- chain and tape methods, instrumental methods, Examples; types of transition curves; Vertical Curves: Necessity and types of vertical curves, setting out of a vertical curve by tangent correction, chord gradient and sight distance method.

COURSE OUTCOMES:

At the end of the course, the students will be able to
- To carry out surveying in the field for various civil engineering projects, prepare a contour map and plan of the area.
- Taking accurate measurements with different surveying instruments.
- Adjustment of traverse, and understand the process of setting of different curves for road and railway designs.

SUGGESTED BOOKS:

- Surveying volume I and II: B C Punmia.
- Engineering Surveying (Sixth Edition): W. Schofield.
- Text Book of Surveying: C. Venkataramiah.
- Introduction to GPS: The Global Positioning System: Ahmed El-Rabbany.
- Various Online resources including NPTEL.

Building Drawing Lab.			
Course Code	LC-CE-209-G	External marks:	25
Credits	1	Internal marks:	25
L-T-P	0-0-2	Total marks:	50
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:
- To understand the principles of planning and bylaws.
- To draw plan, elevation and section of bond in brick work, walls and foundations, load bearing and framed structures.
- To prepare detailed working drawing for different parts of a building.

COURSE CONTENT

LIST OF EXPERIMENTS

1. Cavity Wall.
2. Different Bonds in brick work.
3. Grillage foundation.
4. Preparation of building drawing mentioning its salient features including the following details: a) Ground floor plan b) Two Sectional Elevations c) Front and Side Elevations
5. Plan and Sectional Elevation of different Stair-Cases.
6. Plan and Sectional Elevation of different Doors and Windows.
7. Plan and Sectional Elevation of different Ventilators.
8. Plan and Sectional Elevation of Floors.
9. Plan and Sectional Elevation of different roofs.

Course Outcomes:
At the end of the course, the students will be able to
- Student's ability to perform basic sketching techniques will improve.
- Students will be able to draw orthographic projections and sections.
- Student's ability to use architectural and engineering scales will increase.
- To prepare drawings for doors, windows, floors etc.
- To use various Symbols, Conventions and Abbreviations for building drawing,
- Prepare detail planning for single and two storied residential building and public building.

ENGINEERING MECHANICS LAB			
Course Code	**LC-CE-211-G**	**External marks:**	**25**
Credits	**1**	**Internal marks:**	**25**
L-T-P	**0-0-1**	**Total marks:**	**50**
		Duration of Examination: 3 hrs	

COURSE OBJECTIVES:
- Structural Analysis experiments help to understand, to know the practical behaviour of the physical structures like beams, roof truss etc.
- A proper structural analysis of these structures helps the students to solve the practical problems.
- Different structural apparatus like Simply Supported Beam, Curved Member of different shape, Pin Joint Truss are studied in the laboratory.

LIST OF EXPERIMENTS

1. To determine elastic properties of a beam.

2. Torsion of cylindrical rods (Shaft).

3. To determine and analyse deflection of curved beams.

4. Experimental and analytical study of behaviour of struts with various end conditions.
5. To determine deflection of trusses – Horizontal and vertical deflection of various joints of a pin jointed truss.
6. Experimental and analytical study of a 3bar pin jointed Truss.

7. Experimental and analytical study of an elastically coupled beam.

8. To plot stress- strain curve for mild steel – Demonstration.

COURSE OUTCOMES:
At the end of the course, the students will be able to

- To acquire the knowledge about stresses and strains.
- To get knowledge about loading systems, types of supports and beams and understand the behaviour of different structural system for different loading and deflection.
- Able to calculate the about forces, moments and deflections.
- To verify and compare different theoretical and experimental theorems.
- Analyse and assess the behaviour and serviceability of the structures using analytical/experimental methods.

Fluid Mechanics Lab.			
Course Code	LC-CE-213-G	External marks:	25
Credits	1	Internal marks:	25
L-T-P	0-0-2	Total marks:	50

COURSE OBJECTIVES:
- To understand the physical processes of fluid more closely.
- Various apparatus like, Verification of Bernoulli's theorem apparatus, venturimeter & Orifice meters, orifice & mouth piece apparatus Flow over notches apparatus, vortex flow apparatus etc helps to understand different process.

LIST OF EXPERIMENTS

1. Verification of Bernoulli's Theorem
2. Calibration of V notch
3. Calibration of Rectangular notch
4. Calibration of Trapezoidal notch
5. Study of Pressure Measuring Devices
6. Determination of Metacentric height
7. Hydrostatics Force on Flat Surfaces/Curved Surfaces
8. Venturimeter
9. Orifice meter
10. Determination of coefficient C_d, C_v, and C_c

COURSE OUTCOMES:
At the end of the course, the students will be able to
- Verification of Bernoulli's theorem.
- Calibration of different notches, venturimeter and orifice meter.
- Determination of different coefficient and their verification.
- Study the different property of fluid flow.

Surveying Lab			
Course Code	LC-CE-215-G	External marks:	25
Credits	1	Internal marks:	25
L-T-P	0-0-2	Total marks:	50
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:
- To use of Chain for linear measurement and traversing.
- To use of different compass for determination of directions and for traversing.
- To use different levels and determine the reduced levels, elevation and depressions of ground.
- To prepare maps using plane table by applying different methods.

LIST OF EXPERIMENTS

1. Chain Traversing
2. Compass Traversing
3. Fly Levelling
4. Cross Sectioning
5. Profile levelling
6. Plane Table surveying: Radiation and Intersection
7. Resection- 2 and 3-point problem with plane Table
8. Contouring and preparation contour map.
9. Use of tangent clinometer

COURSE OUTCOMES:
On completion of the course, the students will be able to:
- Use conventional surveying tools such as chain/tape, compass, plane table, levels in the field for various civil engineering applications.
- Enter observation in field book, adjusting and plotting a traverse.
- To calculate the earth work for cutting and filling.
- To prepare contour maps of a small area and its importance in Civil Engineering.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION
Bachelor of Technology (Civil Engineering) Scheme effective from 2019-20
SEMESTER 4th

Sr. No.	Course Code	Course Title	Hours per week L-T-P	Contact hours per week	Credit	Class work	Theory	Practical	Total	Duration of Exam (Hours)
1.	HSMC-202-G	Organization Behavior	3-0-0	3	3	25	75	-	100	3
2.	PCC-CE-202-G	Hydraulic engineering	3-1-0	4	4	25	75	-	100	3
3.	PCC-CE-204-G	Design of concrete structure	3-1-0	4	4	25	75	-	100	3
4.	PCC-CE-206-G	Structural Analysis	2-1-0	3	3	25	75	-	100	3
5.	PCC –CE-208-G	Geomatics & Aerial surveying	3-1-0	4	4	25	75	-	100	3
6.	PCC-CE-210-G	Material Testing & Evaluation	3-0-0	3	3	25	75	-	100	3
7.	LC-CE-212-G	Hydraulic engineering lab	0-0-2	2	1	25	-	25	50	3
8.	LC-CE-214-G	Structural Analysis Lab	0-0-2	2	1	25	-	25	50	3
9.	LC-CE-216-G	Geomatics & Arial surveying Lab.	0-0-2	2	1	25	-	25	50	3
10.	LC-CE-218-G	Material Testing & Evaluation Lab.	0-0-2	2	1	25	-	25	50	3
				TOTAL	25					

Note:

1. Students will be allowed to use non-programmable scientific calculator. However, sharing of Calculator and other materials will not be permitted in the examination.

2. (A) each student has to undergo practical training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc and its evaluation shall be carried out in the V semester on the basis of seminar, viva-voce, report and certificate of practical training obtained by the student.

Course Name	:	ORGANIZATIONAL BEHAVIOUR	
Course Code	:	HSMC-202-G	External marks: 75
Credits	:	3	Internal marks: 25
L-T-P	:	3-0-0	Total marks: 100

Course Objectives:
The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

SYLLABUS
UNIT – 1

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Management and social responsibility, difference between management and administration.

UNIT – 2

Introduction of organization:-
Meaning and process of Organization, Management v/s Organization;
Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB.
Individual Processes and Behavior-Personality- Concept, determinants and applications; **Perception-** Concept, process and applications, **Learning-** Concept ,theories ; **Motivation-** Concept, techniques and importance

UNIT - 3
Interpersonal Processes- Teams and Groups- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership.
Communication – Meaning, process, channels of communication, importance ,barriers and overcome of communication..

UNIT - 4
Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; **Organizational culture** Elements, types and factors affecting organizational culture. **Organizational**

change:
Concept, types & factors affecting organizational change, Resistance to Change.

Course Outcomes: By the end of this course the student will be able to:
1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change

Suggested Books:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi.

Hydraulic engineering			
Course Code	PCC-CE-202-G	External marks:	75
Credits	4	Internal marks:	25
L-T-P	3-1-0	Total marks:	100
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:

- To introduce the students to various hydraulic engineering problems like laminar flow, open channel flows, flow through pipes, hydraulic jump and its applications.
- At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION A

Module 1: **Laminar Flow**
Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.

Module 2: **Turbulent Flow**
Reynolds experiment, Transition from laminar to turbulent flow, Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes

SECTION B

Module 3: Flow through Pipes
Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, siphon, power transmission through pipes, Analysis of pipe networks: water hammer in pipes and control measures, branching of pipes.

SECTION C

Module 4: Open Channel Flow: Uniform flow
Definition, Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channel flow.
Uniform Flow- Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient 'n', Most economical section of channel, Computation of Uniform flow, Normal depth.

Module 5: Open Channel Flow: Non-Uniform Flow
Specific energy, Specific energy curve, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Channel Transitions, Gradually Varied Flow- Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile

SECTION D

Module 6: Hydraulic Jump
Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump,

Module 7:
Surges, Positive and negative surges, Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation,

COURSE OUTCOMES:
- The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
- They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
- They will have knowledge in hydraulic jump and its applications.

SUGGESTED BOOKS:

- Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth,
- Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
- Open channel Flow, K. Subramanya, Tata McGraw Hill.
- Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
- Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers, 1971
- Fluid Mechanic and Hydraulic machines R.K. BANSAL

DESIGN OF CONCRETE STRUCTURE			
Course Code	PCC-CE-204-G	**External marks:**	75
Credits	4	**Internal marks:**	25
L-T-P	3-1-0	**Total marks:**	100
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:

- The aim of this course is to provide students with a thorough understanding of the design of reinforced concrete structures.
- To become familiar with professional and contemporary issues in the design and fabrication of reinforced concrete members.
- Be able to identify and interpret the appropriate relevant industry design codes.
- The course focuses on understanding the behaviour of reinforced concrete components and systems subjected to gravity as well as lateral loads.
- Topics covered will include: design of beams, Column and slabs, detailing of reinforcement, design of foundation and retaining wall.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION-A

Module 1: Design methodology in Reinforced Concrete & Working stress Method
Working stress and limit state methods, Limit state v/s working stress method, Building codes, Normal distribution curve, Characteristic strength and Characteristics loads, Design values, Partial safety factors and Factored loads, Stress-Strain relationship for concrete and steel. Working Stress Method: Basic assumptions, permissible stresses in concrete and steel, design of singly and doubly reinforced rectangular and flanged beams in flexure, steel beam theory, inverted flanged beams, design examples.

Module 2: Limit State Method
Basic assumptions, Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirement and design examples. Continuous Beams both method -Basic assumptions, Moment of inertia, settlements, Modification of moments, maximum moments and shear.

SECTION-B

Module 3: Concrete Reinforcement and Detailing
Requirements of good detailing, Cover to reinforcement, Spacing of reinforcement, Reinforcement Splicing, Anchoring reinforcing bars in flexure and shear, Curtailment of reinforcement. Analysis and Design of Sections in shear, bond and torsion, Diagonal tension, shear reinforcement, Development length, Anchorage and flexural bond, Torsional stiffness, equivalent shear, Torsional reinforcement, Design examples.

Module 4: Serviceability Limit State
Control of deflection, Cracking, Slenderness and vibrations, Deflection and moment relationship for limiting values of span to depth, Limit state of crack width, Design examples.

SECTION-C

Module 5: Slabs
General considerations, Design of one way and two ways slabs for distributed and concentrated loads, Non-rectangular slabs, Openings in slabs, Design Examples.

Module 6: Retaining Walls
Classification, Forces on retaining walls, Design criteria, Stability requirements, Proportioning of cantilever retaining walls, counter fort retaining walls, criteria for design of counter forts, Design examples.

SECTION-D

Module 7: Columns
Effective length, Minimum eccentricity, Short columns, under axial compression, Uniaxial and biaxial bending, Slender columns. Design examples.

Module 8: Footings
Isolated and wall footings, Design examples. Foundations-Combined footings, raft foundation, design of pile cap and piles, under reamed piles, design examples.

Course Outcomes:
At the end of the course, the students will be able to
- Recognize the design philosophy of reinforced concrete structures.
- Be able to analyze reinforced concrete structural systems under gravity and lateral loads.
- Be able to design different elements of reinforced concrete structural systems subjected to gravity and lateral loads.
- Be able to analyze and design a complete structural system through a comprehensive design project.
- Summarize the fundamental mechanics of reinforced concrete and the empirical assumptions made for analysis.

- Be able to produce a complete project document and present in a concise and complete manner to include structural drawings and structural calculations.
- Design basic structural elements (beams, columns and slabs) according to the design approach of IS:456.

SUGGESTED BOOKS:
- Design Of Reinforced Concrete Structures By P.Dayaratnam, Oxford & IBH Pub.,N.Delhi.
- Design of Reinforced Concrete-Limit State Design By A.K.Jain, Nem Chand & Bros.,Roorkee.
- Design of Reinforced Concrete by I.C.Syal & A,K,Goel, A.H,Wheeler & Co.Delhi.Reinforced Concrete Design by S.N.Sinha, Tmh Pub.,N.Delhi.
- Sp-16(S&T)-1980, Design Aids For Reinforced Concrete to IS:456, BIS, N.Delhi.
- Reinfirced cement concrete design by Neelam Sharma , S.K.Kataria & sons, N.Delhi.
- Sp-34(S&T)-1987 Handbook on Concrete Reinforcement And Detailing`, BIS, N.Delhi.

STRUCTURAL ANALYSIS			
Course Code	**PCC-CE-206-G**	**External marks:**	**75**
Credits	3	**Internal marks:**	**25**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and Design Engineering Systems.
- Covers the relationship between stress and strain on deformable solids, principal stresses, maximum shearing stress, and the stresses acting on a structural member.
- Applies analysis to members subjected to axial, bending, and Torsional loads.
- Learn to evaluate internal forces, moments and corresponding stresses in beams through problem solving sessions using different methods.
- This course provides foundation knowledge, skills and their application which are relevant to subsequent courses in Civil Engineering.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION-A

MODULE 1: Deflection of Statically determinate structures
Deflection of determinate beams by Double Integration Method, Conjugate Beam Method and Moment Area Methods, Principle of Virtual work (Unit load method) and Castigliano's theorem.

MODULE 2: Deflection of Statically determinate Frame & Truss
Deflection of determinate pin jointed trusses and rigid jointed frames by principle of virtual work, Strain Energy and Castiglino's theorem. Williot Mohr diagram method and Maxwell's laws of reciprocal theorem

SECTION-B
MODULE 3: Travelling Loads
Maximum Shear Force and Bending Moment diagrams for simply supported beams carrying following moving loads: A Single Concentrated Load, Uniformly Distributed Load, Two Concentrated Loads, fixed distance apart Series of Concentrated Loads, Enveloping parabola, equivalent UDL for BM and SF in each of the above cases.

MODULE 4: Influence Line
Influence lines for reactions, BM & SF for simply supported beam and Panelled Girders.

Influence lines for forces in trusses with top horizontal and curved both, Reversal of stresses, Use of influence lines for calculating design forces due to dead load and moving live loads. Influence lines using Muller Breslau principle.

SECTION-C
MODULE 5: Arches
Determination of horizontal thrust, shear force and bending moment diagram for:
1. Two Hinged Arches **2**. Three Hinged Arches **3**. Fixed Arches

MODULE 6: Column Analogy Method & Cable and Suspension Bridge
Elastic centre, properties of analogous column, application to beam & frames. Introduction of Cable and suspension Bridge uniformly loaded cables, Temperature stresses, and three hinged stiffening Girder and two hinged stiffening girder

SECTION-D
MODULE 7: Indeterminate Structures & Deflection methods
Introduction to Indeterminate Structures, Determination of kinematic and static indeterminacy of beams, frames and trusses, Slope Deflection and Moment Distribution Methods- Analysis of continuous beams & portal frames, Portal frames with inclined members.

MODULE 8: Kani's Method
Analysis of continuous beam and simple frames, Analysis of frames with different column lengths and end condition of the bottom storey.

Course Outcomes:
At the end of the course, the students will be able to:
- Helps to determine the deflections and rotations produced by the three fundamental types of loads: axial, Torsional, and flexural.
- Identify the internal forces and moments in beams to develop shear force and bending moment diagrams. Assess section properties, bending and deflections in beams.
- Use various classical methods for analysis of indeterminate structures.
- Determine the effect of support settlements for indeterminate structures.
- Apply the concepts of ILD and moving loads on structures.
- Demonstrate the concepts of qualitative influence line diagram for continuous beams and frames
- Apply the methods of indeterminate truss analysis demonstrate the behaviour of arches and their methods of analysis.

Suggested Books:
- Statically Indeterminate Structures by C.K. Wang, McGraw Hill Book Co., New York.
- Advanced Structural Analysis by A.K. Jain, Nem Chand & Bros., Roorkee.
- Indeterminate Structures by R.L. Jindal, S. Chand & Co., New Delhi.
- Theory of Structures, Vol. I, by S.P. Gupta & G.S.Pandit, Tata McGraw Hill, New Delhi.

GEOMATICS AND AERIAL SURVEYING			
Course Code	PCC-CE-208-G	External marks:	75
Credits	4	Internal marks:	25
L-T-P	3-1-0	Total marks:	100
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:
- To understand the principle of surveying on very large scale by locating precise horizontal controls.
- To learn about surveying applications in setting out works.
- To learn about determining absolute positions of a point using celestial measurements.
- To learn about different types of errors in measurements and their adjustment.
- To introduce the basic concept of photogrammetry, Remote sensing, and GIS.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION A
Module 1: Triangulation and Trilateration
Triangulation systems, classification, strength of figure, selection of triangulation stations, grade of triangulation, field work of triangulation, triangulation computations, Trilateration-Principle, Methods, advantages and disadvantages, introduction to total station.

Module 2: Survey Adjustment and computations
Definitions, types of error, weight of an observation, law of weights, most probable values, principle of least squares, method of correlates, normal equation, adjustment of triangulation figures by method of least squares.

SECTION B
Module 3: Astronomy
Definitions of astronomical terms, celestial coordinate systems, Napier's rule of circular parts, star at elongation, star at prime vertical, star at horizon, star at culmination, Astronomical triangle, various time systems: sidereal, apparent, solar and mean solar time, equation of time-its cause and effect, inter-conversion of time, determination of azimuth, latitude, longitude etc. by astronomical observations.

SECTION C
Module 4: Elements of Photogrammetry
Introduction, types of photographs, aerial camera, scale of a photograph, height displacements of vertical photographs, flight planning and its uses, crab and drift, number of photographs, relief displacements, Stereoscopic vision and stereoscopes, height determination

from parallax measurement, flight planning, principle of photo interpretation, photogrammetric monitoring.

<div align="center">SECTION D</div>

Module 5: Introduction to remote sensing
Definition of Remote Sensing, types of remote sensing, remote sensing system and components. EMR source and characteristics, active and passive remote sensing, EMR propagation through medium, Role of atmosphere, Atmospheric windows, EMR interaction with objects, Spectral signature, EMR interaction with vegetation, soil and water. Satellite orbits and platforms: Geostationary and sun synchronous satellites, Resolution, Applications of remote sensing in civil engineering.

Module 6: Geographical Information System (GIS)
Definition, and Objectives, Components of GIS, Spatial data models: Raster and Vector, Data inputting in GIS, Linkage between spatial and non spatial data, Spatial data analysis: Vector and raster based spatial data analysis, Integration of RS and GIS data, Digital Elevation Model, GIS Software Packages.

Course Outcomes:
- Students would be able to know about advanced methods of locating horizontal controls.
- Set out various civil engineering structures, learn about different types of time and solution of astronomical triangle.
- Apply corrections to the measurements for different errors, and understand the difference between aerial photograph and satellite images and their use in map making.

Suggested Books:
- Chang.T.K. 2002: Geographic Information Systems, Tata McGrawHill
- Punmia, B.C. 2005: Surveying I and II, Luxmi Publications
- Charles D. Ghilani: Adjustment Computations: Spatial Data Analysis (Fifth Edition)
- Paul R Wolf: Elements of Photogrammetry
- G S Srivastava: An introduction to Geoinformatics
- Basudeb Bhatta: Remote Sensing and GIS
- G. L. Hosmer: Text-book on Practical Astronomy
- Various Online resources including NPTEL

Material Testing and Evaluation			
Course Code	PCC-CE-210-G	External marks:	75
Credits	3	Internal marks:	25
L-T-P	3-0-0	Total marks:	100
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:
- To provide the students an knowledge about various engineering materials.
- To understand the properties of ingredients of concrete.
- To study the behaviour of concrete under different states.
- To study about the concrete design mix.
- To understand special concrete and their use.
- To know various heavy construction projects and the equipments used for these.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carry equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

COURSE CONTENT

SECTION-A

Module 1: Introduction to Engineering Materials
Cements, M-Sand, Concrete (plain, reinforced and steel fibre/glass fibre- reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics and Refractories, Bitumen and asphaltic materials, Glass and Plastics, Structural Steel and other Metals

Module 2: Limes, cement and mortars
Lime: classification of lime, manufacturing, testing of lime, storage of lime, Cement: cements composition, types of cement, manufacturing of ordinary portland cement, special types of cement, storage of cement, testing of cement. Mortars: Proportions of lime and cement mortars, mortars for masonry and plastering.

SECTION-B
Module 3: Concrete making materials
Proportions of cements, aggregates, water and admixtures; properties of fresh and hardened concrete, variability of concrete strength, extreme weather concreting, prestressed concrete; Durability of concrete - alkali aggregate reaction, reinforcement corrosion, freezing and thawing, etc.

Module 4: Mix Design

Principles of concrete mix design, basic considerations, Factors in the choice of mix design, outline of mix design procedure, ACI mix design practice, USBR method, British mix design method IS guidelines.

SECTION-C

Module 5: Steel and its testing

Types of steel, mechanical behaviour and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; tensile test – standards for different material (brittle, quasi-brittle, elastic and so on); Bending and torsion test, procedure and standards, Strength of ceramic, Internal friction, creep – fundaments and characteristics; Brittle fracture of steel – temperature transition approach; concept of fracture mechanics; fracture toughness testing.

SECTION-D

Module 6: Testing and Evaluation Procedures

Testing of concrete mixes, description for various concrete, steels, aggregates ; Elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Shrinkage, Creep.

Module 7: Construction equipments and Heavy Construction

Construction of large structures, dams, bridges, multi storeyed buildings etc, Construction Equipments - crushers, hot mix, plants, dozers etc, Introduction to heavy construction equipment.

Course Outcomes:

At the end of the course, the students will be able to
- To explain various type of constructions in Civil Engineering.
- Design the concrete mix using ACI and IS code methods.
- Determine the properties of fresh and hardened of concrete.
- Design special concretes and their specific applications ensure quality control while testing/ sampling and acceptance criteria.

SUGGESTED BOOKS:

- Handbook of mix design - BIS
- Concrete Technology by M.S. Shetty.
- Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth- Heinemann
- Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
- Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
- Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
- E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
- American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)

HYDRAULIC ENGINEERING LAB.			
Course Code	LC-CE-212-G	External marks:	25
Credits	1	Internal marks:	25
L-T-P	0-0-2	Total marks:	50

COURSE OBJECTIVES:

- To understand the flow measurement in a pipe flow.
- To determine the energy loss in pipe flow.
- To study the loss due to pipe fittings.
- To measure the discharge in a open channel flow etc.

LIST OF EXPERIMENTS

1. To determine the coefficient of drag by Stokes law for spherical bodies.
2. To study the phenomenon of cavitations in pipe flow.
3. To determine the critical Reynolds number for flow through commercial pipes.
4. To determine the coefficient of discharge for flow over a broad crested weir.
5. To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis including friction blocks.
6. To study the scouring phenomenon around a bridge pier model
7. To study the scouring phenomenon for flow past a spur.
8. To determine head loss due to various pipe fittings.

COURSE OUTCOMES:
At the end of the course, the students will be able to:
- Measure discharge in pipes determines the energy loss in conduits.
- Carry out discharge measurements in open channel etc.

STRUCTURAL ANALYSIS LAB			
Course Code	LC-CE-214-G	External marks:	25
Credits	2	Internal marks:	25
L-T-P	0-0-2	Total marks:	50
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:

- Structural Analysis experiments help to understand, to know the practical behaviour of the physical structures like beams, different arches, roof truss etc.
- A proper structural analysis of these structures helps the students to solve the practical problems.
- Different structural apparatus like Two-Hinge Arch, Three- Hinge Arch are studied in the laboratory.

COURSE CONTENT

SECTION-A

1   To verify moment area theorem regarding slope and deflection in a beam
2   To verify Maxwell's Reciprocal Theorem.
3   Begg`sdeformeter- verification of Muller Breslau principle
4   Experiment on a two – hinged arch for horizontal thrust and influence line for horizontal thrust
5   Analytical and experimental study of three hinged arch
6   Experimental and analytical study of unsymmetrical bending of a cantilever beam
7   Sway in portal frames – Demonstration

Course Outcomes:
At the end of the course, the students will be able to:
- Various experimental and analytical studies for different structural members and their comparison.
- Demonstration of frame.
- Able to calculate the about forces, moments and deflections.
- To understand the Able to calculate the deflection of springs
- To verify and compare different theoretical and experimental theorems.

GEOMATICS AND ARIAL SURVEYING LAB.			
Course Code	LC-CE-216-G	External marks:	25
Credits	1	Internal marks:	25
L-T-P	0-0-2	Total marks:	50
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:
- To study and use of theodolite for angle measurements
- To use tacheometer for horizontal and vertical distances.
- To draw simple circular curves.
- To measure base line measurement.
- To study total station and its use for measuring distance, elevation and coordinates.

LIST OF EXPERIMENTS

1. Study various parts of a theodolite
2. Measurement of horizontal and vertical angles with theodolite
3. Measurement of Tachometric constants.
4. Calculating horizontal distance and elevations using tachometer.
5. Exercise of triangulation including base line measurement.
6. Setting out simple circular curves by deflection angle method.
7. Study the various parts of a total station.
8. Measurements of distance, elevation, coordinate with total station.
9. Special problems with total station.

COURSE OUTCOMES:
On completion of the course, the students will be able to:
- Use the theodolite for measuring angles and use of tacheometer to determine distance and elevation.
- Draw simple circular curves.
- Calculate base line measurement and importance of triangulation.
- Use a total station to measure distance, elevation and coordinates.
- Use total station to plot a map of given area with software.

Material Testing & Evaluation Lab.			
Course Code	LC-CE-218-G	External marks:	25
Credits	1	Internal marks:	25
L-T-P	0-0-2	Total marks:	50
		Duration of Examination:	3 hrs

COURSE OBJECTIVES:
- To determine important properties of cement with different tests.
- To study the various test on aggregates and concrete.

LIST OF EXPERIMENTS

1. Standard consistency of cement using Vicat`s apparatus.
2. A) Fineness of cement by Sieve analysis and Blaine`s air permeability method.
   B) Fineness modulus of coarse and fine aggregates.
3. Soundness of cement by Le-Chatelier`s apparatus.
4. Setting time of cement, initial and final of cement.
5. Compressive strength of cement.
6. A) Measurement of specific gravity of cement.
   B) Measurement of Heat of Hydration of cement.
7. Moisture content and bulking of fine aggregate.
8. Workability of cement concrete by (a) Slump test (b) Compaction factor test (c) Flow table test.
9. Compressive strength of concrete by (a) Cube test, (b) Cylinder test
10. Indirect tensile strength of concrete-split cylinder test.
11. Modules of rupture of concrete by flexure test.
12. Bond strength between steel bar and concrete by pull-out test.
13. Non-destructive testing of concrete.

Course Outcomes:
At the end of the course, the students will be able to:
- To able understand the importance of testing of cement, sand and aggregate.
- Able to perform different tests of concrete to check their suitability.
- Study of various properties of cement, aggregate and concrete for any project work.
- To check the suitability of material for practical application.