Semester II						
Sr No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CE 101	Introduction to Civil Engineering	2	1	0	6
2	MA 206	Introduction to Numerical Methods (1st Half)	3	1	0	4
3	MA 103	Differential Equations -I (2nd Half)	3	1	0	4
4	ME 111	Engineering Graphics Lab	0	1	3	5
5	CS 106	Data Structures and Algorithms	3	0	0	6
6	CS 111	Data Structures and Algorithms Laboratory	0	0	3	3
7	ME 113	Hands on Engineering Lab	0	0	3	3
8	ME 201	Engineering Mechanics	2	1	0	6
9	NO 102/ NO 104	National Sports Organization (NSO)/National Service Scheme (NSS)				PP/ NP
		Total Credits				**37**

1	**Title of the course (L-T-P-C)**	**Introduction to Civil Engineering** **2-1-0-6**
2	**Pre-requisite courses(s)**	Nill
3	**Course content**	**Introduction and Scope of Civil Engineering**: Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, History of Civil Engineering: Early constructions and developments over time, ancient monuments of the world, Civil Engineering aspects of Indian heritage structures. Civil Engineering Specializations: Structural Engineering, Geotechnical Engineering, Water Resources Engineering, Environmental Engineering, Transportation Engineering, Construction Management, Ocean Engineering, Remote Sensing and GIS, Energy and Sustainable Infrastructure. **Megastructures of Civil Engineering**: Design, Construction and Structural Details of Some of the Megastructures of the World. Mega Civil Engineering Projects of India. Failure Case Studies in Civil Engineering: Structures, Foundations, Dams, Pavement Systems, and the Geo-environment. Some Major Civil Engineering Challenges **Materials in Civil Engineering**: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals, Structural Steel, High Tensile Steel, Carbon Composites, Plastics in Construction, 3D printing, Recycling of Construction & Demolition wastes, Sustainable Building Materials. **Introduction to Plan Reading, and Construction Techniques**: Scale drawings of floor plans, sections, and elevations; Plan types, Interpretation of plans. Components of a building. Typical loads and forces in Civil Engineering structures. Introduction to estimation and costing. **Smart Cities and Current Trends in Construction Industry**: Application of Machine Learning (ML) and Artificial Intelligence (AI) in Civil Engineering. Position of construction industry vis-à-vis other industries, plan outlays for construction; current budgets for infrastructure works; Possible scopes for a career, Importance of ethics in engineering.
4	**Texts/References**	**Reading:** **1.** J. E. Gordon, “STRUCTURES: Or Why Things Don't Fall Down”, Da Capo Press; Reprint edition, 2003. **2.** Paul A. Bosela, Pamalee A. Brady, Norbert J. Delatte, M. Kevin Parfitt “Failure Case Studies in Civil Engineering: Structures, Foundations, and the Geoenvironment”, American Society of Civil Engineers; 2nd edition 2013. **3.** P.C. Varghese “Building Materials”, Prentice Hall India Learning Private Limited; 2nd edition, 2015. **4.** Gary Anglin, “Introduction to Estimating, Plan Reading and Construction Techniques”, Routledge; 1st edition, 2019. **5.** You-Lin Xu, Jia He “Smart Civil Structures”, CRC Press; 1st edition, 2019. **References:** **1.** Pijush Samui, Dookie Kim, Nagesh Iyer, Sandeep Chaudhary, “New Materials in Civil Engineering”, 1st edition, Elsevier, 2020. **2.** Saeed Moaveni, “Engineering Fundamentals: An Introduction to Engineering” Cengage Learning India Pvt. Ltd.; Fourth edition, 2011. **3.** J. E. Gordon, “The New Science of Strong Materials – Or Why You Don`t Fall through the Floor”, Princeton University Press, 2020. **4.** BIS, “National Building Code of India”, Bureau of Indian Standards, 2017. **5.** M.W.Martin and R.Schinzinger, “Ethics in Engineering” McGraw Hill Education; Fourth edition, 2017. **6.** S.S. Bhavikatti and M.V. Chitawadagi “Building Planning and Drawing”, Dreamtech Press, 2019.

1	**Title of the course (L-T-P-C)**	**Introduction to Numerical Methods (3-1-0-4)**
2	**Pre-requisite courses(s)**	**Calculus, MA101 & Linear Algebra, MA 106**
3	**Course content**	Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical integration, composite rules, error formulae. Solution of a nonlinear equation, bisection and secant methods. Newton's method, rate of convergence, solution of a system of nonlinear equations, Numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor-corrector methods, order of convergence, Finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations. Exposure to MATLAB
4	**Texts/References**	S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980

1	**Title of the course (L-T-P-C)**	**Differential Equations -I (3-1-0-4)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Exact equations, integrating factors and Bernoulli equations. Orthogonal trajectories. Lipschitz condition, Picard's theorem, examples on non-uniqueness. Linear differential equations generalities. Linear dependence and Wronskians. Dimensionality of space of solutions, Abel-Liouville formula. Linear ODE's with constant coefficients, the characteristic equations. Cauchy-Euler equations. Method of undetermined coefficients. Method of variation of parameters. Laplace transform generalities. Shifting theorems. Convolution theorem.
4	**Texts/References**	**1.** E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999) **2.** W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley (2005)

1	**Title of the course (L-T-P-C)**	**Engineering Graphics Lab (0-1-3-5)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Engineering Graphics with mini drafter: Around half a semester and bit more with following topics to be covered. • Introduction to Engineering Graphics • Curves • Projections of Points • Projection of Lines • Projection of Planes • Projections on Auxiliary Planes • Projections of Solids • Sections of Solids • Intersections of Solids Engineering Graphics with 2D Drafting Software: 5 weekly computer laboratory sessions covering above using AutoCAD® as a drafting software, 5th session on Isometric Projections.
4	**Texts/References**	**1.** N. D. Bhatt, revised and enlarged by V. M. Panchal and P. R. Ingle, Engineering Drawing, 53rd Edition, 2014, Charotar Publishers, Anand. **2.** Warren J. Luzadder and Jon M. Duff, Fundamentals of Engineering Drawing, Prentice-Hall of India. **3.** Gopalakrishna K. R., Engineering Drawing Vol. I & II Combined., Subhas Stores, 25th Edition, 2017. **4.** Narayana. K. L., and Kannaiah, P. E., Text Book on Engineering Drawing, 2nd Edition, 2013, Scitech Publications, Chennai. **5.** Venugopal K. and Prabhu Raja V., Engineering Drawing + AutoCAD, New Age International Publishers, 5th Edition, 2011.

1	**Title of the course (L-T-P-C)**	**Data Structures and Algorithms (3-0-0-6)**
2	**Pre-requisite courses(s)**	**Exposure to Computer Programming**
3	**Course content**	Introduction: data structures, abstract data types,analysis of algorithms. Creation and manipulation of data structures: arrays,lists, stacks, queues, trees, heaps, hash tables, balanced trees, tries, graphs. Algorithms for sorting and searching, order statistics, depth-first and breadth-first search, shortest paths and minimum spanning tree.
4	**Texts/References**	**1.** Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Pressand McGraw-Hill, 2009. **2.** Data structures and algorithms in C++, by Michael T. Goodrich, Roberto Tamassia, and David M. Mount,Wiley, 2004.

1	**Title of the course (L-T-P-C)**	**Data Structures and Algorithms Laboratory (0-0-3-3)**
2	**Pre-requisite courses(s)**	**Exposure to Computer Programming (CS 102)**
3	**Course content**	Laboratory course for CS 211 is based on creatingand manipulating various data structures and implementation of algorithms.
4	**Texts/References**	**1.** Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Pressand McGraw-Hill, 2009. **2.** Data structures and algorithms in C++, by Michael T.Goodrich, Roberto Tamassia, and David M. Mount, Wiley, 2004.

1	**Title of the course (L-T-P-C)**	**Hands on Engineering Lab (0-0-3-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	**List of Experiments (Mechanical Workshop)** • To make a Square-fit from the given mid steel pieces (Fitting) • To make a V-fit from the given mid steel pieces (Fitting) • To make a rectangular tray as per required dimensions (Sheet Metal) • To build a transition piece (Sheet Metal) • To make a Butt joint using the given two M.S pieces (Arc welding) • To make a lap joint using the given two M.S pieces (Arc welding) • To build a pipeline using fittings for given flow circuit (Plumbing) **List of Experiments (Electrical Workshop)** • To control one lamp by a one switch with provision for plug socket with switch control (Electrical wiring) • To do staircase wiring (i.e. control of one lamp by two switches fixed at two different places) (Electrical wiring) • Measurement of hot and cold resistance of filament • Improvement of Power Factor • Calibration of Energy meter • Measurement of Power using three ammeter/voltmeter method **List of Experiments (Electronics)** • Understanding breadboard, One-way traffic • Introduction to Arduino and Buzzer • Using Arduino speed measurement of motor/ glowing of LED • Control of water level using Arduino Line follower using Arduino
4	**Texts/References**	Elements of Workshop Technology Vol. 1 (2015), S. K. Hajra Choudhary, A. K. Hajra Choudhary and Nirjhar Roy, Media Promoters and Publishers Pvt. Ltd. W. A. J. Chapman, Workshop Technology, Vol. 1 (2006), Vol 2 (2007), and (1995), CBS Publishers.

1	**Title of the course (L-T-P-C)**	**Engineering Mechanics (2-1-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	**Module 1:** Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. **Module 2:** Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. **Module 3:** Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines. **Module 4:** Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. **Module 5:** Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium. **Module 6:** Particles dynamics- Kinematics of Particles: Rectilinear motion, Plane curvilinear motion - rectangular coordinates, normal and tangential coordinates, polar coordinates, Space curvilinear - cylindrical, spherical (coordinates), Relative and Constrained motion. Kinetics of Particles: Force, mass and acceleration – rectilinear and curvilinear motion, work and energy, impulse and momentum – linear and angular; Impact – Direct and Oblique. Kinetics of System of Particles: Generalized Newton's Second Law, Work-Energy, Impulse-Momentum, Conservation of Energy and Momentum. **Module 7:** Introduction to Rigid body dynamics Kinematics of Planar Rigid Bodies: Equations for rotation of a rigid body about a fixed axis, General plane motion, Instantaneous Center of Rotation in Plane Motion Plane Motion of a Particle Relative to a Rotating Frame. Coriolis Acceleration Kinetics of Planar Rigid Bodies: Equations of Motion for a Rigid Body, Angular Momentum of a Rigid Body in Plane Motion, Plane Motion of a Rigid Body and D'Alembert's Principle.

		Systems of Rigid Bodies, Constrained Plane Motion; Energy and Work of Forces Acting on a Rigid Body, Kinetic Energy of a Rigid Body in Plane Motion, Systems of Rigid Bodies, Conservation of Energy, Plane Motion of a Rigid Body - Impulse and Momentum, Systems of Rigid Bodies, Conservation of Angular Momentum. **Module** 8: Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulums, use of simple, compound and torsion pendulums
4	**Texts/References**	**Textbooks:** **1.** J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 6th Ed, John Wiley, 2008. **2.** F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, 9th Ed, Tata McGraw Hill, 2011.R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2006. **References:** **1.** S. P. Timoshenko and D. H. Young, Engineering Mechanics. Fourth Edition. McGraw-Hill, New York, 1956 **2.** I. H. Shames, Engineering Mechanics: Statics and dynamics, 4th Ed, PHI, 2002. **3.** Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Dynamics – Computational Edition, 1st Ed., Cengage Learning, 2007 **4.** Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Statics-Computational Edition, 1st Ed., Cengage Learning, 2007