Recommended Syllabus For CET (Engineering)-2018
MATHEMATICS

1.	Trigonometry	Angle and its measurements, Standard angles, Angles in quadrant and quadrantal angles, Relation between degree measure and radian measure, Length of arc of a circle, Area of sector, Trigonometric ratios : Trigonometric ratios of any angle, Signs of Trigonometric ratios in different quadrants, Fundamental identities , Trigonometric ratios of compound angles, Trigonometric ratios of allied angles, Trigonometric ratios of multiple angles, Trigonometric ratios of half angles, Factorization and Defactorization formulae , Sum and difference of two angles , Properties of Triangle : Trigonometric ratios of angles of a triangle, Cosine rule, Sine rule, Projection rule, Inverse Circular functions : Properties of inverse circular functions. General solution of Trigonometric equations. Area of triangle.
2.	Determinant	Determinant of order 3, (Expansion and Properties), Cramer's rule, Condition of consistency, Area of a triangle.
3.	Sets, Relations and Functions	Review of set theory, Power set, Cartesian product, Relations, Functions, Types of functions, Graphs of functions, Composite function, Inverse function, Constant function.
4.	Logarithm	Introduction and definition, Laws of logarithm with proof, Change of base, Numerical Problems.
5.	Complex Numbers	Complex Number in the form $a+ib$, Modulus, Complex Conjugate, Argument of Complex Number, Algebra of Complex numbers, Square roots of Complex numbers, Argand diagram.
6.	Quadratic Equations	Roots of equation, Nature of roots, Sum and product of roots, Formation of quadratic equation, Symmetric functions of roots, Complex cube roots of unity.
7.	Sequences and Series	Arithmetic Progression, Geometric progression, Harmonic progression, Arithmetic mean, Geometric mean, Harmonic mean , Special series : $\sum n$, $\sum n^2$, $\sum n^3$ and their uses.
8.	Permutations and Combinations	Factorial Notation, Properties of n!, Fundamental Principle of Counting, Permutations, Permutations of repeated objects, Circular permutation, Combinations, Relation between permutations and combinations, Properties of combination.

9.	Mathematical Induction and Binomial Theorem	Principle of Mathematical Induction and its applications, Binomial Theorem for, $n \hat{I} N$ (statement only), Obtaining general term in the expansion. Binomial theorem for any index. Binomial coefficients.
10.	Limits & Continuity	Standard Limits, Definitions, Algebra of limits (without proof), Limit at infinity, Continuity of a function at a point, Continuity at a function in the interval, Algebra of continuous functions, Types of discontinuity, Continuity of some standard functions.
11.	Differentiation	Definition of Derivative, Derivatives of (a) Constant functions,(b) Power functions, (c) Trigonometric functions, Derivatives of log x, a^x, e^x (without proof), Rules of Differentiations :(a) Derivative of sum (b) Derivative of Difference (c) Derivative of product (d) Derivative of Quotient, Derivative from first principle, Relation between continuity and differentiability, Derivative of composite function, Derivative of inverse functions, Derivative of implicit functions, Derivative of parametric functions, Second order derivative.
12.	Applications of Derivatives	Increasing and decreasing functions, Tangent and normal at a point to, a curve, Rate measurer, related rates, Approximations and small errors, Maxima and minima. Problems based on Cauchy's Mean value theorem and Rolle's mean value theorem.
13.	Integration	Definition of an Integral, Integral as a limit of sum, Integrals of some standard functions. Rules of integration. Definite Integrals, Methods of integration., a) Substitution Method., b) Integration by parts., c) Integration by partial fractions., Definite integrals, (a) Fundamental Theorem of integral calculus (without proof)., (b) Properties of definite integrals. Simple integral of the following type: $$\int \frac{dx}{x^2 - a^2}, \quad \int \frac{dx}{\sqrt{x^2 - a^2}}, \quad \int \frac{dx}{ax^2 + bx + c}, \quad \int \frac{dx}{\sqrt{ax^2 + bx + c}}$$ $$\int \frac{px + q}{ax^2 + bx + c}\, dx, \quad \int \frac{px + q}{\sqrt{ax^2 + bx + c}}\, dx, \quad \int \sqrt{a^2 - x^2}\, dx,$$ $$\int \sqrt{ax^2 + bx + c}\, dx, \quad \int (px + q)\sqrt{ax^2 + bx + c}\, dx$$
14.	Application of integral	Area under the curve, Volume of solid by revaluation,

15.	Differential equations	Definitions of Differential equation, order, degree, General solution and Particular solution., Formation of Differential equation., Solutions of First order and first degree differential equations. a) Variables separable method (b) Homogeneous and non homogeneous differential equations, Applications of Differential equations, Growth and decay. Newton's law of cooling, Half life period, Surface area.
16.	Boolean Algebra	Boolean Algebra as an algebraic structure, Principle of duality, Boolean function and switching circuits, Application of Boolean Algebra to switching circuits.
17.	Mathematical Logic	Statements, Truth values of statement, Compound statement, Logical connectives and truth table, Statement pattern and logical equivalence, Tautology, Contradiction, Contingency, Applications of logic to switching circuits, Quantifiers and quantified statements, Negation of compound statement, Negation of quantified statement.
18.	Matrices	Definition and types of matrices, Algebra of matrices, Elementary transformation and Inverse of Matrix by elementary transformation, Minors and cofactor of elements, Adjoint of matrix, Inverse by adjoint method, Solution of Linear Equations by reduction method and inversion method.
19.	Plane Co ordinate Geometry	Locus : definition of locus, Equation of locus, Point of locus, Shift of origin.

Line : Definition of line, slope of line, equation of lines in standard forms, general equation, angle between two lines, point of intersection of lines, conditions of concurrent lines, distance of a point from a line, family of lines Pair of straight lines : Pair of lines passing through origin, Pair of lines not passing through origin. Condition that general second degree equation in x and y represents a pair of lines, conditions of parallel lines and perpendicular lines, angle between the lines represented by

$$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = o$$

Circle : Different forms of Equations of a circle, Standard equation, General equation, Centre radius form, Parametric equation of a circle, Tangent and normal, Equations of tangent and normal, condition of tangency to the standard circle, Director circle, Length of tangent segment, tangent in terms of slope,

Conics : Definition of conic, Equations of conics, Focus, Directrix, Eccentricity, Classification of conics, Standard equations of parabola, Ellipse, Hyperbola, Tangents and Normals, Equation of tangent and normal at a point, condition of tangency, tangent in terms of slope. Number of tangents from a point to conic (parabola, Ellipse, Hyperbola). Director circle.

20.	Vectors	Scalar and vector, Different types of vectors, Collinear vectors, Co-planar vectors , Algebra of vectors , Addition of vectors, Scalar multiplication of Vectors, Position vectors, Scalar products and its properties, Vector products and its properties, Angle between two vectors, Collinearity and Coplanarity of vectors, Section formula., Midpoint formula, Centroid formula, Scalar triple product., Volume of parallelopiped, Applications of vectors to Geometry. Applications of vectors to mechanics. Vector area of triangle and parallelogram.
21.	Three Dimensional Geometry	Direction Cosines and Direction Ratios: Relation between direction cosines and direction ratios, Angle between two lines, Condition of perpendicular and parallel lines,
		Line : Equation of line passing through given point and parallel to given vector, Equation of line passing through given two points, (Vector and Cartesian form), Plane: Equation of plane in different forms, Equation of plane passing through three points, angle between two planes, (Vector and Cartesian form). Distance of line from a point, Skew lines Distance between skew lines. Distance between parallel lines.
		Plane : Angle between line and plane, coplanarity of two lines. Distance of a point from a plane. Equation of plane passing through the intersection of two planes.
22.	Linear Programming	Solution of linear inequalities in one & two variable, Introduction of concepts, Formation of linear programming problem, Graphical solution of linear programming problem. Solution of linear programming problems by graphical methods (a) ISO profit and ISO cost line (b) Corner method.
23.	Statistics	Measures of dispersion : Range, Mean Deviation, Variance and standard deviation, Quartile deviation,
		Bivariate frequency Distribution: Tabulation, Correlation, Scatter diagram, Covariance, Karl Pearson's coefficient of correlation.
		Probability : Events and Algebra of events, Definition of probability, Addition theorem, Multiplication theorem, Conditional probability, Independent events, Baye's theorem, Random variable, Discrete and continuous random variable, Probability distribution of discrete and continuous random variable. Binomial distribution, Bernoulli Trial, Binomial distribution. Condition for Binomial Distribution. Mean and variance of Binomial distribution. Normal distribution. Mean and variance of Normal distribution. Standard Normal variables.

PHYSICS

CONTENTS CLASS XI SYLLABUS

UNIT I: Physical World and Measurement

- *Physics:* Scope and excitement; nature of physical laws; Physics, technology and society.
- *Need for measurement:* Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures.
- Dimensions of physical quantities, dimensional analysis and its applications.

UNIT II: Kinematics

- Frame of reference, Motion in a straight line; Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity. Uniformly accelerated motion, velocity-time and position-time graphs, for uniformly accelerated motion (graphical treatment).
- Elementary concepts of differentiation and integration for describing motion. *Scalar and vector quantities:* Position and displacement vectors, general vectors, general vectors and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity.
- Unit vectors. Resolution of a vector in a plane-rectangular components.
- Scalar and Vector products of Vectors. Motion in a plane. Cases of uniform velocity and uniform acceleration- projectile motion. Uniform circular motion.

UNIT III: Laws of Motion

- Intuitive concept of force. Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications.
- Equilibrium of concurrent forces. Static and Kinetic friction, laws of friction, rolling friction, lubrication.
- *Dynamics of uniform circular motion.* Centripetal force, examples of circular motion (vehicle on level circular road, vehicle on banked road).

UNIT IV: Work, Energy and Power

- Work done by a constant force and variable force; kinetic energy, work-energy theorem, power.
- Notion of potential energy, potential energy of a spring, conservative forces; conservation of mechanical energy (kinetic and potential energies); non-conservative forces; motion in a vertical circle, elastic and inelastic collisions in one and two dimensions.

UNIT V: Motion of System of Particles and Rigid Body

- Centre of mass of a two-particle system, momentum conservation and centre of mass motion. Centre of mass of a rigid body; centre of mass of uniform rod.
- Moment of a force,-torque, angular momentum, conservation of angular momentum with some examples.
- Equilibrium of rigid bodies, rigid body rotation and equation of rotational motion, comparison of linear and rotational motions; moment of inertia, radius of gyration. Values of M.I. for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems and their applications.

UNIT VI: Gravitation

- Kepler's laws of planetary motion. The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth.
- Gravitational potential energy; gravitational potential. Escape velocity, orbital velocity of a satellite. Geostationary satellites.

UNIT VII: Properties of Bulk Matter

- Elastic behavior, Stress-strain relationship. Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity, poisson's ratio; elastic energy.
- Viscosity, Stokes' law, terminal velocity, Reynold's number, streamline and turbulent flow. Critical velocity, Bernoulli's theorem and its applications.
- Surface energy and surface tension, angle of contact, excess of pressure, application of surface tension ideas to drops, bubbles and capillary rise.
- Heat, temperature, thermal expansion; thermal expansion of solids, liquids, and gases. Anomalous expansion. Specific heat capacity: Cp, Cv- calorimetry; change of state – latent heat.
- Heat transfer- conduction and thermal conductivity, convection and radiation. Qualitative ideas of Black Body Radiation, Wein's displacement law, and Green House effect.
- Newton's law of cooling and Stefan's law.

UNIT VIII: Thermodynamics

- Thermal equilibrium and definition of temperature (zeroth law of Thermodynamics). Heat, work and internal energy. First law of thermodynamics. Isothermal and adiabatic processes.
- *Second law of the thermodynamics:* Reversible and irreversible processes. Heat engines and refrigerators.

UNIT IX: Behaviour of Perfect Gas and Kinetic Theory

- Equation of state of a perfect gas, work done on compressing a gas.
- *Kinetic theory of gases:* Assumptions, concept of pressure. Kinetic energy and temperature; degrees of freedom, law of equipartition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path.

UNIT X: Oscillations and Waves

- Periodic motion-period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion(SHM) and its equation; phase; oscillations of a spring-restoring force and force constant; energy in SHM –Kinetic and potential energies; simple pendulum-derivation of expression for its time period; free, forced and damped oscillations (qualitative ideas only), resonance.
- Wave motion. Longitudinal and transverse waves, speed of wave motion. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics. Beats. Doppler effect.

CONTENTS OF CLASS XII SYLLABUS

UNIT I: Electrostatics

- Electric charges and their conservation. Coulomb's law-force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.
- Electric field, electric field due to a point charge, electric field lines; electric dipole, electric field due to a dipole; torque on a dipole in a uniform electric field.
- Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside)
- Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges:equipotential surfaces, electrical potential energy of a system of two point charges and of electric diploes in an electrostatic field.
- Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor, Van de Graaff generator.

UNIT II: Current Electricity

- Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with elec tric current; Ohm's law, electrical resistance, *V-I* characteristics (liner and non-linear), electrical energy and power, electrical resistivity and conductivity.
- Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance.
- Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel.
- Kirchhoff's laws and simple applications. Wheatstone bridge, metre bridge.
- Potentiometer-principle and applications to measure potential difference, and for comparing emf of two cells; measurement of internal resistance of a cell.

UNIT III: Magnetic Effects of Current and Magnetism

- Concept of magnetic field, Oersted's experiment. Biot-Savart law and its application to current carrying circular loop.
- Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids. Force on a moving charge in uniform magnetic and electric fields. Cyclotron.
- Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors-definition of ampere. Torque experienced by a current loop in a magnetic field; moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter.
- Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moment of a revolving electron. Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements.
- Para-, dia-and ferro-magnetic substances, with examples.
- Electromagnetic and factors affecting their strengths. Permanent magnets.

UNIT IV: Electromagnetic Induction and Alternating Currents

- Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, Eddy currents. Self and mutual inductance.
- Alternating currents, peak and rms value of alternating current/ voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, wattles current.
- AC generator and transformer.

UNIT V: Electromagnetic Waves

- Need for displacement current.
- Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves.
- Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses.

UNIT VI: Optics

- Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Magnification, power of a lens, combination of thin lenses in contact combination of a lens and a mirror. Refraction and dispersion of light through a prism.
- Scattering of light- blue colour of the sky and reddish appearance of the sun at sunrise and sunset.
- *Optical instruments:* Human eye, image formation and accommodation, correction of eye defects (myopia and hypermetropia) using lenses.
- Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.
- *Wave optics:* Wavefront and Huygens' principle, reflection and refraction of plane wave at a plane surface using wavefronts.
- Proof of laws of reflection and refraction using Huygens' principle.
- Interference, Young's double hole experiment and expression for fringe width, coherent sources and sustained interference of light.
- Diffraction due to a single slit, width of central maximum.
- Resolving power of microscopes and astronomical telescopes. Polarisation, plane polarized light; Brewster's law, uses of plane polarized light and Polaroids.

UNIT VII: Dual Nature of Matter and Radiation

- Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation- particle nature of light.
- Matter waves- wave nature of particles, de Broglie relation. Davisson-Germer experiment (experimental details should be omitted; only conclusion should be explained).

UNIT VIII: Atoms and Nuclei

- Alpha- particle scattering experiments; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, atomic masses, isotopes, isobars; isotones.

- Radioactivity- alpha, beta and gamma particles/ rays and their properties decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, nuclear fission and fusion.

UNIT IX: Electronic Devices

- Energy bands in solids (qualitative ideas only), conductors, insulators and semiconductors; semiconductor diode- I-V characteristics in forward and reverse bias, diode as a rectifier; I-V characteristics of LED, photodiode, solar cell, and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.