MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

MUST KNOW CONCEPTS — MKC

MATHS — **2021-22**

Course Code & Course Name : 19BSS23&Transforms and Partial Differential Equations

Year/Sem/Sec : II / III / CSE B

S.No	Term	Notation (Symbol)	Concept/Definition/Meaning/Units/ Equation/Expression	Units
		Unit-I Fourier Transforms		
1	Transform		A Transformation is a process that manipulate a polygon or other two dimentional objects on a plane or coordinate system. Mathematical transformations describe how two dimentional figures move around a plane or coordinate system.	
2	Types of transformation		1. Dilation 2. Reflection 3. Rotation 4. Shear 5. Translation	
3	Fourier Transform		It is a way of transforming a continuous signal into the frequency domain.	
4	Discrete Fourier Transform (DFT)		It is a discrete numerical equivalent using sums instead of integrals that can be computed on a digital computer.	
5	Applications of DFT		As one of the applications DFT and then inverse DFT can be used to compute standard convolution product and thus to perform linear filtering.	
6	Uses of Fourier Transform		The Fourier Transform of a musical chord is a mathematical representation of the amplitudes of the individual notes that make it up.	
7	Uses of Fourier Transform		1. X-ray diffraction 2. Electron microscopy 3. NMR spectroscopy 4. IR spectroscopy 5. Fluorescence spectroscopy 6. Image Processing	

8	Time Domain		The original signal depends on time.	
9	Frequency Domain		The original signal depends on frequency.	
10	Difference between Time and Frequency Domain analysis		• The time domain analysis examine the amplitude vs time characteristics of a measuring signal. • Frequency domain analysis replaces the measured signal with the group of sinusoidal which, when added together, produce the waveform equivalent to original.	
11	Fourier Transform Pair		If f(x) is a given function, then Fourier transform and its inverse Fourier transform are called Fourier transform pair.	
12	Fourier Transform Pair	$F[f(x)] = \mathrm{F(s)}$	If f(x) is a given function, then $F[f(x)] = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(x).e^{isx}\,dx = \mathrm{F(s)}$ $and\ f(x) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} F(s).e^{-isx}\,ds$ are called Fourier transform pair.	
13	Properties of Fourier Transforms		• Convolution Theorem • Correlation Theorem • Wiener – Khinchin Theorem • Parseval's Theorem	
14	Linear property		If $F[f(x)] = \mathrm{F(s)}$ and $F[g(x)] = \mathrm{G(s)}$ then $F[af(x) \pm bg(x)] = aF(s) \pm bG(s)$	
15	Shifting theorem		If $F[f(x)] = \mathrm{F}(s) then F[f(x-a)] = e^{ias}F(s)$	
16	Change of scale property		If $F[f(x)] = \mathrm{F(s)}$ then $F[f(ax)] = \frac{1}{a}F\left(\frac{s}{a}\right)$	
17	Modulation theorem		If $F[f(x)] = \mathrm{F(s)}$ then $F[f(x)cosax] = \frac{1}{2}[F(s+a) + F(s-a)]$	
18	Convolution theorem	$*$	The Fourier transform of the convolution of two functions f(x) and g(x) is the product of their Fourier transform $F[(f(x) * g(x)] = F(S)G(S) = F[f(x)]F[g(x)]$.	
19	Convolution	$F[f(x)] = \mathrm{F(s)}$ $F[g(x)] = \mathrm{G(s)}$	If $F[f(x)] = \mathrm{F(s)}$ and $F[g(x)] = \mathrm{G(s)}$ then convolution of f(x) & g(x) is defined as $(f * g)\ (x) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(t)g(x-t)dt$	
20	Applications of Convolution		• It is used to merge signals • It is used to apply operations like smooting and filtering images where the primary task is selecting the appropriate filter template or mask. • It is used to find gradient of the image.	

21	Parseval's identity		If f(x) is defined $(-\infty,\infty) and F[f(x)] =$ F(s) then $\int_{-\infty}^{\infty}\|f(x)\|^2dx = \int_{-\infty}^{\infty}\|F(s)\|^2dx.$	
22	Concept of parseval's Theorem		The sum (or intergral) of the square of the function is equal to the sum (or intergral) of the square of its transform.	
23	Fourier sine transform pair	$F_s[f(x)] = F_S(s)$	The Fourier sine transform of f(x) is $F_s[f(x)] = F_S(s) = \sqrt{\frac{2}{\pi}}\int_0^{\infty} f(x)\sin sxdx$ The inverse Fourier sine transform of $F_s(s)$ is defined by $f(x)= \sqrt{\frac{2}{\pi}}\int_{-\infty}^{\infty} F_s(s)\, sinsxds$	
24	Fourier cosine transform pair	$F_c[f(x)] = F_c(s)$	The Fourier sine transform of f(x) is $F_c[f(x)] = F_c(s) = \sqrt{\frac{2}{\pi}}\int_0^{\infty} f(x) cossx\ dx$ The inverse Fourier sine transform of $F_c(s)$ is defined by $f(x)= \sqrt{\frac{2}{\pi}}\int_{-\infty}^{\infty} F_c(s)\, cossxds$	
25	Self reciprocal		If the fourier transform of f(x) is f(s) then f(x) is said to be self –reciprocal under fourier transform.	
Unit-II Z – Transforms and Difference Equations				
26	Z- Transform (one sided or unilateral)		Let $\{ f(n)\}$ be a sequence defined for n = 0,1,2,3,… and $f(n) = 0$ for n < 0 then its Z- transform is defined as $Z[f(n)] = F[z] =\sum_{n=0}^{\infty} f(n)\, Z^{-n}$	
27	Z- Transform (two sided or bilateral)		Let $\{ f(n)\}$ be a sequence defined for all integers then its Z- transform is defined as $Z[f(n)] = F[z] =\sum_{n=-\infty}^{\infty} f(n)\, Z^{-n}$	
28	Uses of Z-Transform		The Z-Transform is a mathematical tool commonly used for the analysis and synthesis of discrete time control system.	
29	Differentiation in then Z-Domain		If $Z[f(n)] = F[z]$ then $Z[nf(n)] = -Z\frac{d}{dz}F[z]$	
30	Second Shifting Theorem		If $Z[f(n)] = F[z]$ then i).$Z[f(n+1)] = ZF[z] - Zf[0]$ ii). $Z[f(n+2)] = Z^2F[z] - Z^2f[0] - Zf[0]$ iii).$Z[f(n+k)] = Z^kF[z] - Z^kf[0] - Z^{k-1}f[1] - Z^{k-2}f[2] - \cdots - Z^{k-(k-1)}$ iv). $Z[f(n-k)] = Z^{-k}F[z]$	
31	Initial value theorem		$If\ z[f(n)] = F[z] then$ $f(0) = \lim_{z\to\infty} F[z].$	
32	Final value theorem		$If z[f(n)] = F[z]$ $then \lim_{n\to\infty} f[n] = \lim_{z\to 1}(z-1)F[z].$	
33	Convolution theorem of Z		If $Z[f(n)] = F[z] \& Z[g(n)] = G[z]$then $Z^{-1}\{ f(n) * g(n)\} =$ **F(z)** G(z)	

	Transform.			
34	Convolution of two functions	$*$	$f(n) * g(n) = \sum_{k=0}^{n} f(k) . g(n-k)$.	
35	Z- Transform of $cosn\theta$		$$Z[cosn\theta] = \frac{z(z - cos\theta)}{z^2 - 2zcos\theta + 1}$$	
36	Z- Transform of $sinn\theta$		$$Z[sinn\theta] = \frac{zsin\theta}{z^2 - 2zcos\theta + 1}$$	
37	Advantages of Z-transform		(i) It is easy and time consuming to solve difference equation. (ii)It is faster than Laplace transform to solve difference equation.	
38	Unit step sequence	$u(k)$	$$u(k): \{1,1,1,\ldots..\} = \begin{cases} 1, & k \geq 0 \\ 0, & k < 0 \end{cases}$$	
39	Zeros		When X(Z) is a rational function. i.e., a ration of polynomial in Z, then the roots of the numerator polynomial are referred to as the zeros of X(Z).	
40	Poles		When X(Z) is a rational function. i.e., a ration of polynomial in Z, then the roots of the denominator polynomial are referred to as the poles of X(Z).	
41	Z-Transform at work		• Z-Transform takes a sequence of X_n numbers and transform it into an expression X(Z) that depends on the variable Z but not n. That's the transform part. • So the problem is transformed from the sampled time domain (n) to the Z domain	
42	Applications of Z-Transforms		The field of signal processing is essentially a field of signal analysis in which they are reduced to their mathematical components and evaluated. One important concept in signal processing is that of the Z-Transform , which converts unwidely sequences into forms that can be easily dealt with. Z-Transforms are used in many signal processing systems.	
43	Uses of Z-Transforms		It can be used to solve differential equations with constant coefficients.	
44	Differentiation in the Z-Domain		If $Z[f(n)] = F[z]$ then $Z[nf(n)] = -z\frac{d}{dz}F[z]$	
45	Damping Rule		If $Z[u(n)] = U[z]$ Then $Z[a^{-n}u(n)] = U[az]$ which is called Damping rule because the geometric factor a^{-n} when $\|a\| > 0$ damps the function $u(n)$	
46	Difference Equation		A difference equation is relation between the difference of an unknown function at one or more general values of the argument.	

47	Order of a Difference Equation		The order of a Difference Equation is the difference between the largest and the smallest arguments occurring in the difference equation divided by the unit of increment.	
48	Solution of a Difference Equation		The solution of the Difference Equation is an expression for $y(n)$ which satisfies the given difference equation.	
49	Procedure to solve Difference equation using Z-Transform		1. Apply the Z-Transform to the difference equation. 2. Substitute the initial conditions. 3. Solve for the difference equation in the Z-Transform domain. 4. Find the solution in the time domain by applying the inverse Z-Transform.	
50	Inverse Z-Transform		The Inverse Z-Transform of $Z[f(n)] = F[z]$ is defined as $Z^{-1}[f(z)] = f(n)$	
		Unit – III Fourier Series		
51	Fourier Series		A series of sine and cosine of an angle and its multiples of the form $$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n con\, nx + \sum_{n=1}^{\infty} b_n \sin nx$$ is called the Fourier series . Where $a_0, a_n and\ b_n$ are Euler (or) Fourier constants.	
52	Periodic Function		A function $f(x)$ is said to be periodic , if and only if $f(x+p) = f(x)$ is true for some value of p and every value of x The smallest value of p is called the period of the function $f(x)$	
53	Dirichlet's conditions		1. $f(x)$is well defined in the defined interval . 2. $f(x)$has a finite number of finite discontinuities in the defined interval . 3. $f(x)$has at most a finite number of maxima and minima in the defined interval.	
54	Uses of Dirichlet's condition		The Dirichlet's conditions are sufficient conditions for a real-valued, periodic function f to be equal to the sum of its Fourier series at each point where f is continuous.	
55	Odd function		A function $f(x)$is said to be odd, if and only if $$f(-x) = -f(x)$$	
56	Even function		A function $f(x)$is said to be odd, if and only if $$f(-x) = f(x)$$	
57	Neither even nor odd function		A function$f(x)$is said to be Neither even nor odd function, if and only if $$f(-x) \neq f(x) \neq -f(x)$$	
58	Types of intervals in Fourier series		1. $(0\,, 2\pi)$ 2. $(-\pi\,, \pi)$ 3. $(0\,, 2l)$ 4. $(-l\,, l)$	
59	Importance of Fourier series in		The Fourier series of functions in the differential equation often gives some prediction about the behavior of the	

	engineering		solution of a differential equation. They are useful to find out the dynamics of the solution.	
60	Application of Fourier series		1. Image Processing 2. Heat distribution mapping 3. Wave simplification 4. Light simplification 5. Radiation measurements	
61	Real life application of Fourier series		1. Signal Processing 2. Approximation Theory 3. Control Theory	
62	Application of Fourier series in Engineering		The Fourier series has many such applications in electrical engineering, vibration analysis, acoustics, optics, signal processing, image processing, quantum mechanics, econometrics, thin-walled shell theory, etc…	
63	Uses of Fourier series		• Fourier series are particularly suitable for expansion of periodic functions. • We come across many periodic functions in voltage, current, flex, density, applied force, potential and electromagnetic force in electricity. • Fourier series are very useful in electrical engineering problems.	
64	Advantage of Fourier series		• The main advantage of Fourier analysis is that very little information is lost from the signal during the transformation. • The Fourier transform maintains information on amplitude, harmonics, and phase and uses all parts of the waveform to translate the signal into the frequency domain.	
65	Disadvantage of exponential Fourier series		The major disadvantage of exponential Fourier series is that it cannot be easily visualized as sinusoids.	
66	Limitations of Fourier series		It can be used only for periodic inputs and thus not applicable for aperiodic one. It cannot be used for unstable or even marginally stable systems.	
67	Bernoulli's Formula	$\int udv$	$\int udv = uv - u' v_1 + u'' v_2 - \ldots\ldots$	
68	Purpose of Bernoulli's equation		The Bernoulli equation is an important expression relating pressure, height and velocity of a fluid at one point along its flow.	
69	Parseval's Theorem		Let f(x) be a periodic function defined in the interval (a,b) then $\frac{a_0^2}{4} + \frac{1}{2}\sum_{n=1}^{\infty}[a_n^2 + b_n^2] = \frac{1}{b-a}\int_a^b [f(x)]^2\, dx$ if the interval is (a,b)	
70	Root Mean Square (RMS) Value	$\bar{y}$	Let f(x) be a periodic function defined in the interval (a,b) then $\bar{y} = \sqrt{\frac{1}{b-a}\int_a^b [f(x)]^2\, dx}$is called the Root Mean Square (RMS) Value of f(x) and it is denoted by $\bar{y}$.	

71	Half Range series		1. If f(x) is Half range cosine series then $b_n = 0$ 2. If f(x) is Half range sine series then $a_0, a_n = 0$	
72	Advantage of Half range Fourier series		A Half range Fourier series is a Fourier series defined on an interval instead of the more common, with the implication that the analyzed function should be extended to as either an even or odd function.	
73	Harmonic Analysis		The process of finding the Fourier series for a function given by numerical values is known as Harmonic Analysis $f(x) = \frac{a_0}{2} + (a_1 \cos x + b_1 \sin x) + (a_2 \cos 2x + b_2 \sin 2x) + (a_3 \cos 3x + b_3 \sin 3x) + \cdots$	
74	Application of Harmonic Functions		Harmonic functions are important in the areas of applied mathematics, engineering and mathematical physics. They are used to solve problems involving steady state temperatures, two-dimensional electrostatics and ideal fluid flow.	
75	Uses of Harmonic analysis		The analysis of harmonics is the process of calculating the magnitudes and phases of the fundamental and high order harmonics of the periodic waveforms.	
Unit- IV Boundary Value Problems				
76	Boundary value problem		A boundary value problem is differential equation together with a set of additional restraints, called the boundary conditions.	
77	Boundary Condition		A Boundary value problem is a differential equation together with a set of additional constrains.	
78	Initial value problem		The auxiliary conditions are at one point of the independent variable	
79	Wave equation		The wave equation is an important second-order linear partial differential equation for the description of waves.	
80	Heat equation		The heat equation is an important partial differential equation which describes the distribution of heat(or variation in temperature) in a given region over time.	
81	One dimensional wave equation		$\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$	
82	The constant a^2 in wave equation		$a^2 = \frac{T}{m} = \frac{Tension}{mass\ per\ unit\ length\ of\ the\ string}$	
83	One dimensional heat equation		$\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$	
84	The constant a^2 in heat equation		$\alpha^2 = \frac{k}{\rho c} = \frac{Thermal\ conductivity}{(Density)(Specific\ heat)}$	
85	Assumption made in the derivative of one dimensional wave		• The motion takes place entirely in one plane. The mass of the string per unit length is constant. • The tension T is constant at all times and at all points of he deflected string. • The string is perfectly flexible, i.e., it can transmit	

			tension but not bending or sheering forces.	
86	In One dimensional heat equation, what is α^2		$\alpha^2 = \frac{k}{\rho c} = \frac{Thermal\ \ conductivity}{(Density\ )(Specific\ \ heat\ )}$	
87	Gradient	$\frac{\partial u}{\partial x}$	The rate of change of temperature with respect to distance is called temperature (or) gradient	
88	Steady state condition		Steady state condition in heat flow means that the temperature at any point in the body does not vary with time. $\frac{\partial u}{\partial t} = 0.$	
89	Thermally insulated		If an end of heat conducting body is Thermally insulated means that no heat through that section. Mathematically the temperature gradient is zero at that point. i.e., $\frac{\partial u}{\partial x} = 0.$	
90	Fourier law of heat conduction	k	The rate at which heat across any area (A)is proportional to the area and to the temp gradient normal to the curve .	
91	Specific Heat		The amount of heat required to produce a given temperature change in a body is proportional to the mass of the body and to the temperature change. This constant of proportionality is known as the specific heat of the conducting material.	
92	Classification of second order Quasi Linear PDE		B^2- 4AC <0 Elliptic Equation B^2- 4AC =0 Parabolic Equation B^2- 4AC >0 Hyperbolic Equation	
93	Fourier law of heat conduction.		The rate at which heat flows across any area is proportional to the area and to the temperature gradient normal to the curve. This constant of proportionality is known as thermal conductivity of the material. It is known as Fourier law of heat conduction	
94	Difference between the solutions of one dimensional wave equation and one dimensional heat equation.		The correct solution of one dimensional wave equation is of periodic in nature. But the solution of heat flow equation is not periodic in nature.	
95	Steady state solution of two dimensional heat equation		When the heat flow is along curves, instead straight lines, the curve lying in parallel planes, the flow is called two dimensional. The two dimensional heat flow equations $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$.	
96	Two dimensional heat flow equation		$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0.$ i.e., $\nabla^2 u = 0$ this is known as Laplace's equation.	
97	Steady State in heat conduction		In steady state, the temperature at any point depends only on the position of the point and is independent of the time t.	
98	Unsteady State in heat conduction		In unsteady state, the temperature at any point of the body depends on the position of the point and also the time t.	
99	Application		• In electrostatics, a common problem is to find a function which describes the electric potential of a	

			given region. If the region does not contain charge, the potential must be a solution to Laplace's equation (a so-called harmonic function). • The boundary conditions in this case are the Interface conditions for electromagnetic fields. If there is no current density in the region, it is also possible to define a magnetic scalar potential using a similar procedure.	
100	Uses of Boundary value Problems		Boundary value problems for large scale nonlinear evolution equations are often required in engineering and scientific applications. Some examples are: incompressible Navier-Stokes equations, problems in elasticity, cosmology, material science, semiconductor device simulation	
Unit-V Partial Differential Equations				
101	Partial Differential Equations (PDE)	$\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial^2}{\partial x \partial y}$	A PDE is one which involves partial derivatives. For example $x^2\frac{\partial z}{\partial x} + y^2\frac{\partial z}{\partial y} = z^2$ is a PDE.	
102	Concept of PDE		A PDE is a mathematical equation that involves two or more independent variables, an unknown function (dependent on those variables), and partial derivatives of the unknown function with respect to the independent variable.	
103	Linear PDE		A PDE is said to be linear , if the dependent variable and the partial derivatives occur in the first degree only.	
104	Non Linear PDE		A PDE is said to be non linear , if the dependent variable and the partial derivatives occur in more than one degree .	
105	Formation of PDE		• By eliminating arbitrary constants that occur in the functional relation between the dependent and independent variables • By eliminating arbitrary functions from a given relation between the dependent and independent variables.	
106	Order of PDE		The order of a PDE is the order of the highest partial differential coefficient occurring in it.	
107	Degree of PDE		The degree of the highest derivative is the degree of the PDE.	
108	Order of PDE got by eliminating arbitrary functions		The elimination of one arbitrary function will result in a PDE of the first order. The elimination of two arbitrary functions will result in equations of second order and so on.	
109	Method to solve the first order PDE		The general form of a first order PDE is $f(x,y,z,p,q) = 0$, where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$.	
110	Types of solution of a PDE		1. Complete Solution (or) Integral 2. Singular Solution (or) Integral	

			3. General Solution(or) Integral	
111	Complete Integral (or) Complete Solution		A solution which contains as many arbitrary constants as there are independent variables is called a complete integral or complete solution.	
112	Particular Integral (or) Particular Solution		A solution obtained by giving particular values to the arbitrary constants in a complete integral is called a particular integral or particular solution.	
113	General Integral (or) General Solution		A solution of a PDE which contains the maximum possible number of arbitrary functions is called a general integral or general solution.	
114	Clairaut's form	Z	The equation of the form $z = px + qy + f(p,q)$ is called Clairaut's form.	
115	Lagrange's Linear Equation		An equation of the form $Pp + Qq = R$ is known as Lagrange's equation when P,Q,& R are functions of $x, y$and$z$.	
116	Method to solve Lagrange's Linear Equation		1. Method of grouping 2. Method o Multipliers	
117	Method of Grouping		In the subsidiary equation $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ if the variables can be separated in any pair of equations, then we get a solution of the form $u(x,y) = a \& v(x,y) = b$.	
118	Method of Multipliers		Choose any three multipliers l, m, n which may be constants (or) function of $x, y \& z$ we have • $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R} = \frac{ldx + mdy + ndz}{lP + mQ + nR}$. • If it is possible to choose l, m, n such that $lP + mQ + nR = 0$,then $ldx + mdy + ndz = 0$. We get a solution $u(x,y) = a \& v(x,y) = b$. • The multipliers l, m, n are called Lagrange's multiplier.	
119	Categories of PDE of higher order with constant Coefficient		1. Homogeneous PDE with constant coefficients. 2. Non-homogeneous PDE with constant coefficients	
120	Homogenous and Non homogeneous PDE		A linear PDE with constant coefficients in which all the partial derivatives are of the same order is called homogeneous; otherwise it is called non-homogeneous.	
121	Common types of PDE		Elliptic, Parabolic, and hyperbolic partial differential equations.	
122	Application of PDE		In many engineering or science problems, such as heat transfer, elasticity, quantum mechanics, water flow and others, the problems are governed by partial differential equations.	
123	Solution of PDE		A solution or integral of a partial differential equation is a relation between the independent and the dependent variables which satisfies the given partial differential equation.	

124	Uses of PDE		• Fluid mechanics, heat and mass transfer, and electromagnetic theory are all modeled by partial differential equations and all have plenty of real life applications. • Heat and mass transfer is used to understand how drug delivery devices work, how kidney dialysis works, and how to control heat for temperature-sensitive things. It probably also explains why thermoses work.	
125	Examples of PDE		PDE'S are used to model many systems in many different fields of science and engineering. • Laplace Equation • Heat Equation • Wave Equation	
		Placement Questions		
126	Percentage		Percent implies "for every hundred" and the sign % is read as percentage and x % is read as x per cent. In other words, a fraction with denominator 100 is called a per cent. For example, 20 % means 20/100	
127	Probability		A probability is a number that reflects the chance or likelihood that a particular event will occur.	
128	Rules of Probability		There are three basic rules associated with probability: the addition, multiplication, and complement rules. The addition rule is used to calculate the probability of event A or event B happening We express it as: P(A or B) = P(A) + P(B) - P(A and B)	
129	Example of probability		The probability of flipping a coin and it being heads is 1/2, because there is 1 way of getting a head and the total number of possible outcomes is 2 (a head or tail). The probability of something which is certain to happen is 1. The probability of something which is impossible to happen is 0.	
130	Permutation		Permutation is defined as arrangement of r things that can be done out of total n things. This is denoted by nPr.	
131	Combination		Combination is defined as selection of r things that can be done out of total n things. This is denoted by nCr.	
132	nCr and nPr stands for		In nCr and nPr, C stands for Combinations, and P stands for permutations. Now for combinations, it is the number of ways you can pick r objects out of n.	
133	Average		The average of n quantities of the same kind is equal to the sum of all the quantities divided by the number of quantities;	

			Average = $\frac{\text{Sum of quantities}}{\text{Number of quantities}}$	
134	The concept of Time and Work		Time and work problems deal with the simultaneous performance involving the efficiency of an individual or a group and the time taken by them to complete a piece of work. Work is the effort applied to produce a deliverable or accomplish a task.	
135	The concept of ratio & Proportion		Ratio: A ratio is the comparison of two homogeneous quantities, or a ratio is the division of two quantities a and b having the same units. It is denoted by a:b (read as "a ratio b") or a/b. Probability: It is defined by Equality between two Ratios.	
136	Arithmetic Progression(AP)		Arithmetic progression(AP) or arithmetic sequence is a sequence of numbers in which each term after the first is obtained by adding a constant, d to the preceding term. The constant d is called common difference. An arithmetic progression is given by a, (a + d), (a + 2d), (a + 3d), ... where a = the first term , d = the common difference	
137	Geometric Progression(GP)		Geometric Progression(GP) or Geometric Sequence is sequence of non-zero numbers in which theratio of any term and its preceding term is always constant. It is denoted by a, ar^2,ar^3	
138	Prime Number		Prime number: A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself. For example, 2, 3, 5, 7, 11, 13, etc. are prime numbers.	
139	Co-Prime Number		Two numbers are said to be relatively prime, mutually prime, or co-prime to each other when they have no common factor or the only common positive factor of the two numbers is 1. In other words, two numbers are said to be co-primes if their H.C.F. is 1.	
140	L.C.M		L.C.M. is the least non-zero number in common multiples of two or more numbers.The least number which is exactly divisible by each one of the given numbers is called their L.C.M.	
141	Methods of finding the L.C.M. of a given set of numbers?		(i) Factorization Method: Resolve each one of the given numbers into a product of prime factors. Then, L.C.M. is the product of highest powers of all the factors. (ii) Division Method (short-cut): Arrange the given numbers in a row in any order. Divide by a number which divided exactly at least two of the given numbers and carry forward the numbers	

			which are not divisible. Repeat the above process till no two of the numbers are divisible by the same number except 1. The product of the divisors and the undivided numbers is the required L.C.M. of the given numbers.	
142	H.C.F		The highest common factor of two or more numbers is the greatest number which divides each ofthem exactly without any remainder.	
143	Reciprocal or Inverse Ratio		If the antecedent and consequent of a ratio interchange their places.The new ratio is called the inverse ratio of the first ratio. In other words, if a ≠ 0, b ≠ 0 then the reciprocal ratio of a : b is . Clearly, is same as b : a. Thus the reciprocal ratio of a : b is b : a	
144	Selling Price (SP) & Cost Price (CP)		The price at which goods are sold is called the selling price. The price at which goods are bought is called the cost price	
145	Profit		When the selling price is more than the cost price, then the trader makes a profit. It is denoted by Profit = SP - CP.	
146	Loss		When the selling price is less than the cost price, then the trader makes a loss. It is given as Loss = CP - SP.	
147	Simple Interest		Simple interest is determined by multiplying the daily interest rate by the principal by the number of days that elapse between payments.	
148	The terms involved in calculating Simple Interest?		S.I = PNR/100 Where, P= Principle N= No.of Years R = Rate of Interest	
149	Compound Interest		Compound interest is calculated on the principal amount and also on the accumulated interest of previous periods, and can thus be regarded as "**interest on interest**".	
150	Odd one out		A person or thing that is different from or kept apart from others that form a group or set is called as odd one out Example : Apple, Onion, potato, Brinjal In this Apple is Odd one out because it is a fruit while remaining are vegetables	

Faculty Team Prepared **Signatures**

1. **P.Jothi**

HoD