ST. JOSEPH'S DEGREE COLLEGE, SUNKESULA ROAD, KURNOOL.
DEPARTMENT OF MATHEMATICS
CERTIFICATE COURSE

COURSE DETAILS:

Title of the Paper	:	**MSc., Entrance Coaching**
Subject	**:**	**Mathematics**
Course Level	:	**Under graduate**
Course Duration	:	8 WEEKS
Faculty Members	:	1. B.Lakshmanna
		2. Dr.T.Mohan Reddy
		3. A. Sarala Kumari
		4. S.Shahanaz Begum
		5. S.Ajay Kumar
		6. B.Chandra Sekhar
		7. P.Vidya Lakshmi

Course Layout :

Week 1	:	Ordinary Differential Equations & Partial Differential Equations
Week 2	:	Three Dimensional Solid Geometry
Week3 & 4	:	Abstract Algebra and Linear Algebra
Week 5 & 6	**:**	Ring theory and Vector Calculus
Week 7	:	Real Analysis.
Course Type	:	Certificate course
Start Date	:	21-01-2019
End Date	:	20-03-2019
Exam Date	:	23-03-2019

ST. JOSEPH'S DEGREE COLLEGE, SUNKESULA ROAD, KURNOOL.
PG ENTRANCE SYLLABUS
MATHEMATICS

UNIT: I Ordinary Differential Equations

Differential equations, integrating factors, Bernoulli's equation, exact differential equations, necessary and sufficient conditions for exactness, symbolic operators, homogeneous and non-homogeneous linear differential equations with constant coefficients and those reducible to such equations, Miscellaneous forms of differential equations, first order higher degree equations solvable for X, Y, Z, P equations from which one variable is explicitly absent, Clairut's form, equations reducible to Clairut's form,

Partial Differential Equations: Formation of partial differential equations, order and degree of partial differential equations, concept of linear and non-linear partial differential equations, linear partial differential equation of first order, Lagrange's method, Geometrical interpretation of the form $Pp + Qq = R$, Charpit's method

UNIT: II Three Dimensional Solid Geometry

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. System of conics. Confocal conics. Polar equation of a conic, tangent and normal to the conic. Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres. Co-oxal system of spheres. Cones. Right circular cone, enveloping cone and reciprocal cone. Cylinder: Right circular cylinder and enveloping cylinder

UNIT III: Abstract Algebra and Linear Algebra

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Lagrange's theorem and its consequences, Normal subgroups, Quotient groups. Homomorphism, isomorphism, auto morphism and inner auto morphism of a group. Auto morphism of cyclic groups, Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem, Centre of a group and derived group of a group

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vector space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension. Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vector spaces, Vector space of all the linear transformations Dual Spaces, Bi dual spaces, annihilator of subspaces of finite dimensional vector spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem.

Eigen values and Eigen vectors of linear transformations. Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt, Orthogonalization process.

UNIT: IV Ring theory and Vector Calculus

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphism's, ideals (principle, prime and Maximal) and Quotient rings, Field of quotients of an integral domain. Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation. Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives. Gradient of a scalar point function, geometrical interpretation of grad., character of gradient as a point function. Divergence and curl of vector point function, characters of Div. and Curl as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator. Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates. Vector integration; Line integral, Surface integral, Volume integral. Theorems of Gauss, Green & Stokes and problems based on these theorems.

UNIT: V Real Analysis

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighbourhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Boral Theorem. Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequence's, Sub sequential limits. Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series. Infinite series: D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's Nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test. Alternating series, Leibnitz's test, absolute and conditional convergence, Arbitrary series: Abel's lemma,

Request Letter

Date:04-01-2019,
Kurnool.

To
Dr.C. V. Satya Narayana
SJCQAC Coordinator,
St. Joseph's Degree College,
Kurnool-518004.

Respected sir,

The Department of Mathematics would like to introduce Certificate Course on "M.Sc. Maths Entrance exam" for 3rd year mathematics students. The course duration will be 45 hours. In this regard, I request you to grant permission to go ahead with our proceedings.

Thanking you sir,

Dr.T. Mohan Reddy,
Head of the Department,
Department of Mathematics
St. Joseph's Degree College,
Kurnool.

Circular

Date: 06--01-2019,
Kurnool.

Dear Students,

The Department of Mathematics is going to give **"MSc Entrance coaching"** for all final year mathematics students. It is proposed to conduct classes from 21st January 2019. This is a certificate course which is about to have 8 weeks. This coaching is very useful to crack entrance exam and can enhance your preparation strategy. So I request all students to make use of this opportunity. For further information, visit department of Mathematics.

Thanking you,

Dr.T. Mohan Reddy,
Head of the Department,
Department of Mathematics
St. Joseph's Degree College,
Kurnool.


No of Present


1104


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Students List:

Name of the Student	Class	Mobile No	Email ID	Signature
M. Yamunadevi	III MSCS	7032541910	Yamunadevi98765@gmail.com	M. Yamunadevi
K. Sridivya	III MSCS	9059214360	Sridivya97033@gmail.com	K. Sridivya
B. Supriya	III MSCS	9121465806	bBontalasupriya4@gmail.com	B. Supriya
V. Aishwarya	III MSCS	6302127697	aishwaryavankadari@gmail.com	V. Aishwarya
N. Varalakshmi	III MSCS	8639713148	nallapativara1998@gmail.com	N. Varalakshmi
V. Neelima Bai	III MSCS	9182718608	neelimabai1008@gmail.com	V. Neelima Bai
M. Jayalakshmi	III MSCS	6281663848	mjayalakshmi3953@gmail.com	M. Jayalakshmi
K. Gayathri	III MSCS	7993936354	kammarigayathri21221@gmail.com	K. Gayathri
S. Swarnalatha	III MSCS	9441864888	sankaliswarna@gmail.com	S. Swarnalatha
S. Ramani	III-MSCS	9705286458	satarlaramani1999@gmail.com	S. Ramani
S. Vineela	III-MSCS	9121443306	vineelaraj2711@gmail.com	S. Vineela
P. Manasa	III MSCS	9381857361	manasa.p@gmail.com	P. Manasa
B. NaveenaRani	III MSCS	8106219539	naveenarani4093@gmail.com	B. NaveenaRani
R. Prathiba	IV MSCS	9866871283	reddyprathibha405@gmal.com	R. Prathiba
Suneetha	III MSCS	7702367928	saisunitha113@gmail.com	M. Suneetha
Bhoomika	III MSCS	6301630713	bhoomikareddy1514@gmail.com	P. Bhoomika
Niveditha	III MSCS	9666851853	v.niveditha82@gmail.com	V. Niveditha
Suhasini	III MSCS	8341108139	KasiReddysravanthi123@gmail.com	K. Suhasini
Jyothirmai	III MSCS	9542292917	Jyothirmai830@gmail.com	P. Jyothi
Shanthy	III MSCS	9182117545	shanthi222000@gmail.com	Y. [illegible]

Head
Dept. of Mathematics
St. Joseph's Degree College
KURNOOL.

No	Name of the Student	Class	Mobile No	Email ID	Signature
	K. Solomon Raju	III MPCs	6301199204	rajusolomon1563@gmail.com	K. Solomon Raju
	C.B. Venkatesh	III MPCS	8520010065	Venkycb85@gmail.com	C.B. Venkatesh
	D. Dastagiri	III MPCS	8247756514	dadekuladastagiri32@gmail.com	D. Dastagiri
	K. Maruthi	III MPCS	9491254096	maruthikaranam99@gmail.com	K. Maruthi
	K. Venkatakrishna Murthy	III MPCS	8520890603	Kotha Venki143143@gmail.com	K. Venkatakrishna
	U. Veera Arun Kumar	III MPCS	9959987927	Veeraarunkumar444@gmail.com	U. Arunkumar
	M. Aijaz	III MPCS	8332090862	shaikaju1999@gmail.com	M. Ajaz
	B. Sateesh	IV MPC'S	9492160915	Sateeshbestha12@gmail.com	B. Sateesh
	B. Ravi	III MPC'S	9703423875	ravibangaru89@gmail.com	Ravi B
	K. Bhaskar Reddy	III MPC'S	9010197151	bhaskarreddy7151@gmail.com	K. Bhaskar Reddy
	D. Sujeeth Kumar	III MPC'S	9014488908	dhapapogusojeethkumar@gmail.com	D. Sujeeth Kumar
	M Vamsi krishna	III MPC'S	9701620902	vamsikrishna7463@gmail.com	M. Vamsi Krishna
	E. Deva Sai Kalyan Goud	III MPC'S	9703214616	Deva Kalyan1010@gmail.com	E. Deva Sai Kalyan Goud
	C. Bharath Kumar	III MPC'S	9642732447	bharath29091998@gmail.com	C. Bharath Kumar
	M. Raja Sekhar	III MPC'S	9398626583	m.rajasekhar004@gmail.com	M. R
	Thirumalesh	III MPCS	9381164696	tirumal goud2@gmail.com	Thirumalesh
	Rohith Kumar	III MPCS	6302519031	raj rohith 08307@gmail.com	K. Rohith Kumar
	Rajasekhar	III MPCS	8522067539	rajasekharbugide@gmail.com	B. Rajasekhar
	Prudhvi	III MPCS	9491722057	prudhvichandu1430@gmail.com	M. Prudhvi

Head
Dept. of Mathematics
St. Joseph's Degree College
KURNOOL.

ST. JOSEPH'S DEGREE COLLEGE, SUNKESULA ROAD, KURNOOL.
PG ENTRANCE MODEL EXAM

MATHEMATICS

Max time :1 hour 30 minutes Max Marks : 50

(1) How many elements are there in $\mathbb{Z}[i]/\langle 3+i\rangle$?

A) infinite B) 3
C) 10 D) finite but not 3 or 10.

(2) Let P be the set of all $n \times n$ complex Hermitian matrices. Then P is a vector space over the filed of

A) $\mathbb{C}$ B) $\mathbb{R}$ but not $\mathbb{C}$
C) both $\mathbb{R}$ and $\mathbb{C}$ D) $\mathbb{C}$ but not $\mathbb{R}$.

(3) Which one of the following is true?

A) There are infinitely many one-one linear transformations from $\mathbb{R}^4$ to $\mathbb{R}^3$
B) The dimension of the vector space of all 3×3 skew-symmetric matrices over the field of real numbers is 6
C) Let F be a field and A a fixed $n \times n$ matrix over F. If $T : M_n(F) \to M_n(F)$ is a linear transformation such that $T(B) = AB$ for every $B \in M_n(F)$, then the characteristic polynomial for A is the same as the characteristic polynomial for T
D) A two-dimensional vector space over a field with 2 elements has exactly 3 different basis.

(4) Let V and W be vector spaces over a filed F. Let $S : V \to W$ and $T : W \to V$ be linear transformations. Then which one of the following is true?

A) If ST is one-to-one, then S is one-to-one
B) If $V = W$ and V is finite-dimensional such that $TS = I$, then T is invertible
C) If $\dim V = 2$ and $\dim W = 3$, then ST is invertible
D) If TS is onto, then S is onto.

(5) The order of the automorphism group of Klein's group is

A) 3 B) 4 C) 6 D) 24.

(6) Which one of the following group is cyclic?

A) The group of positive rational numbers under multiplication
B) The dihedral group of order 30
C) $\mathbb{Z}_3 \oplus \mathbb{Z}_{15}$
D) Automorphism group of $\mathbb{Z}_{10}$.

(7) Which one of the following is a field?

A) An infinite integral domain B) $\mathbb{R}[x]/\langle x^2-2\rangle$
C) $\mathbb{Z}_3 \oplus \mathbb{Z}_{15}$ D) $\mathbb{Q}[x]/\langle x^2-2\rangle$.

(8) Which one of the following is true for the transformation $T : P_2(\mathbb{R}) \to P_2(\mathbb{R})$ defined by $T(f) = f + f' + f''$?

A) T is one-to-one but not onto
B) T is onto but not one-to-one
C) T is invertible
D) the matrix of T with respect to the basis $\{1, x, x^2\}$ is upper triangular.

(9) In $\mathbb{Z}[x]$, the ideal of $\langle x\rangle$ is

A) maximal but not prime B) prime but not maximal
C) both prime and maximal D) neither prime not maximal.

(10) Which one of the following is true for the transformation $T : M_n \to \mathbb{C}$ defined by $T(A) = \operatorname{tr} A = \sum_{i=1}^{n} A_{ii}$?

A) Nullity of T is $n^2 - 1$ B) Rank of T is n
C) T is one-to-one D) $T(AB) = T(A)T(B)$ for all $A, B \in M_{n\times n}$.

(11) Let $W_1 = \{A \in M_n(\mathbb{C}) : A_{ij} = 0 \ \forall\, i \le j\}$ and W_2 is the set of symmetric matrices of order n. Then the dimension of $W_1 + W_2$ is

A) n B) $2n$ C) n^2 D) $n^2 - n$.

(12) The logarithmic map from the multiplicative group of positive real numbers to the additive group of real number is

A) a one-to-one but not an onto homomorphism
B) an onto but not a one-to-one homomorphism
C) not a homomorphism
D) an isomorphism.

(13) If f is a group homomorphism from $(\mathbb{Z}, +)$ to $(\mathbb{Q} - \{0\}, \cdot)$ such that $f(2) = 1/3$, then the value $f(-8)$ is

A) 81 B) 1/81 C) 1/27 D) 27.

(14) The quotient group $\mathbb{Q}_8/\{1,-1\}$ is isomorphic to

A) $(\mathbb{Q}_8, \cdot)$ B) $(\{1,-1\}, \cdot)$
C) $(V_4, +)$ D) $(\mathbb{Z}_4, +)$.

(15) The converse of Lagrange's theorem does not hold in

A) A_4, the alternating group of degree 4
B) $A_4 \times \mathbb{Z}_2$
C) the additive group of integers modulo 4
D) Klein's four group.

(16) The ring $(R, +, \cdot)$ is an integral domain when R is

A) $M_2(\mathbb{Z})$
B) $\mathbb{Z}_7$
C) $\mathbb{Z}_6$
D) $C[0,1]$ of all continuous functions from $[0,1]$ to $\mathbb{R}$.

(17) The polynomial ring $\mathbb{Z}[x]$ is

A) a field
B) a principal ideal domain
C) unique factorization domain
D) Euclidian domain.

(18) An algebraic number is a root of a polynomial whose coefficients are rational. The set of algebraic numbers is

A) finite B) countably infinite
C) uncountable D) none of these.

(19) Let $f : A \to A$ and $B \subset A$. Then which one of the following is always true?

A) $B \subset f^{-1}(f(B))$ B) $B = f^{-1}(f(B))$
C) $B \subset f(f^{-1}(B))$ D) $B = f(f^{-1}(B))$.

(20) Which one of the following does not imply $a = 0$?

A) For all $\epsilon > 0$, $0 \le a < \epsilon$ B) For all $\epsilon > 0$, $-\epsilon < a < \epsilon$
C) For all $\epsilon > 0$, $a < \epsilon$ D) For all $\epsilon > 0$, $0 \le a \le \epsilon$.

(21) Let X and Y be metric spaces and $f : X \to Y$ be continuous. Then f maps

A) open sets to open sets and closed sets to closed sets
B) compact sets to bounded sets
C) connected sets to compact sets
D) bounded sets to compact sets.

(22) Suppose $f : [0,1] \to \mathbb{R}$ is bounded. Then

A) f is Riemann integrable on $[0,1]$
B) f is continuous on $[0,1]$ except for finitely many points implies f is Riemann integrable on $[0,1]$
C) f is Riemann integrable on $[0,1]$ implies f is continuous on $[0,1]$
D) f is Riemann integrable on $[0,1]$ implies f is monotone function.

(23) Let $f : \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = \sin x^3$, then f is

A) uniformly continuous
B) not differentiable
C) continuous but not uniformly continuous
D) not continuous.

(24) Consider the sequence $\langle f_n \rangle$ defined by $f_n(x) = 1/(1+x^n)$ for $x \in [0,1]$. Let $f(x) = \lim_{n\to\infty} f_n(x)$. Then

A) For $0 < a < 1$, $\langle f_n \rangle$ converges uniformly to f on $[0,a]$
B) the sequence $\langle f_n \rangle$ converges uniformly to f on $[0,1]$
C) the sequence $\langle f_n \rangle$ converges uniformly to f on $[1/2, 1]$
D) the sequence $\langle f_n \rangle$ converges uniformly to f on $[0,1]$.

(25) The open unit ball $B((0,0),1)$ in the metric space $(\mathbb{R}^2, d)$ where the metric d is defined by $d((x_1,y_1),(x_2,y_2)) = |x_1 - x_2| + |y_1 - y_2|$ is the inside portion of

A) the circle centered at the origin and radius 1
B) the rectangle with vertices at $(0,1)$, $(1,0)$, $(-1,0)$, $(0,-1)$
C) the rectangle with vertices at $(1,1)$, $(1,-1)$, $(-1,1)$, $(-1,-1)$
D) the triangle with vertices $(0,1)$, $(-1,-1)$, $(1,-1)$.