P.R.GOVERNMENT COLLEGE, KAKINADA

An Autonomous Institution & NAAC Acredited with "A" Grade (CGPA 3.17)

BOARD OF STUDIES

2018-19

MATHEMATICS

DEPARTMENT OF MATHEMATICS AND STATISTICS

INDEX

P. R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA, E. G. Dt.

Department of Mathematics and Statistics

The Board of Studies meeting for **Mathematics** subject during the academic year 2018-2019 is conducted at the Dept. of Mathematics and Statistics on 07-04-2018 at 10 a.m. with Smt. Dr. V. Anantha Lakshmi, Lect. In-charge in the chair along with the following members.

Name, designation and Address	Signature
1. **Chair Person** Dr. V. Anantha Lakshmi Lecturer in Mathematics, P.R. Govt. College (A), Kakinada.	V. Anantha Lakshmi 7/4/18
2. **University Nominee** Dr. T. Hymavathi, Principal, College of Science & Technology, AKNU, Rajahmundry.	T. Hymavathi 7/4/18
3. **Members nominated by Executive council of the College:**	
(a) Dr.K.V.Anandam Principal, MVNJS & RVR College, Malikipuram.	K.V.Anandam 7-4-18
(b) Dr.P.Subhashini, Lecturer in Mathematics & Principal (FAC), Government Degree College, Ramachandrapuram.	Subhashini
(c) Sri K.Chittibabu, Lecturer in Mathematics, Government Degree College, Ramachandrapuram.	K. Chittibabu 7/4/18
4. **From Alumni:** (a) Sri P.S.R.Subrahmanyam, HOD of Mathematics, Ideal College of Arts &Science(A), Kakinada.	Subrahmanyam 7/4/18
	G. Subha
5. **Members from the college:** Faculty members:	
(a) Ms. N. Suneetha, G/F in Mathematics	N Suneetha
(b) Ms. V. Hari Priya, G/F in Mathematics	V. Haripriya
(c) Smt. G. Subha, G/F in Mathematics	
(d) Ms. T. Varsha Sri, G/F in Mathematics	Varsha.T
Student Members:	
1 S. Rekha Devi II MPC (EM)	S. Rekhadevi
2. A. Srinu, I MPC (EM)	
3. P. Kishore II MPC (EM)	P. Kishore

(Dr. C. Krishna)

P.R.Government College (Autonomous), Kakinada

Department of Mathematics & Statistics

Agenda for BOS meeting in Mathematics

1. Revamping of syllabus for 5^{th} and 6^{th} semesters.
2. Department Action plan for 2018-19.
3. Model question papers and Blue Print.
4. Syllabus and Model Paper for Analytical Skills to all students in IV semester.
5. Panel of Question Paper Setters and Examiners.
6. Additional inputs in to the curriculum.
7. Internal Assessment weightage 40% to I and II year students.
8. Any other proposal with the permission of the chair.

BLUE PRINT OF C.B.C.S. MODEL CURRICULUM IN B.Sc MATHEMATICS

Yr.	Course & Theory	Paper	Title	Workload Hrs./week	Credits	Max. Marks		
						Intrnl.	Extrnl	Tot.
I	Sem I	I	Differential Equations	6Hrs	5	40	60	100
	Sem II	II	Solid Geometry	6Hrs	5	40	60	100
II	Sem III	III	Abstract Algebra	6 Hrs	5	40	60	100
	Sem IV	IV	Real Analysis	6 Hrs	5	40	60	100
	All IV Sem. students		Analytical Skills	2Hrs	2	-	50	50
III	Sem. V Th	V	Ring Theory & Vector Calculus	3Hrs	3	30	70	100
		VI	Linear Algebra	3 Hrs	3	30	70	100
	Sem. V Problem Solving Sessions		Ring Theory & Vector Calculus	2 Hrs	1	10	40	50
			Linear Algebra	2 Hrs	1	10	40	50
	Sem. VI Theory	VII	Elective (any one)* A. Laplace-Transformations B. Numerical Analysis C. Number Theory D. Graph Theory	3 Hrs	3	30	70	100
		VIII A.	1.Integral Transformations 2. Special Functions 3. Project	3 Hrs (for each paper)	3	30	70	100
		VIII B.	1. Advanced Numerical Analysis 2. special Functions 3. Project	3 Hrs (for each paper)	3	30	70	100

		VIII C.	1. Principles of Mechanics 2. Fluid Mechanics 3. Project	3 Hrs (for each paper)	3	30	70	100
		VIII D	1. Applied Graph Theory 2. special Functions 3. Project	3 Hrs (for each paper)	3	30	70	100
	Sem. VI Problem Solving Sessions		Elective Problem Solving Sessions	2 Hrs	1	10	40	50
			In any Cluster paper 1 Problem Solving Session	2 Hrs (for each paper)	1	10	40	50
			In any Cluster paper 2 Problem Solving Session	2 Hrs (for each paper)	1	10	40	50
	Project		Project work	5 Hrs	5			100

Total number of hours for theory papers and labs in an academic year:

Theory Paper I & II : 180 Hrs

Theory Paper III & IV : 180 Hrs

Theory Paper V & VI : 90 Hrs — Lab III : 30 Hrs (15 sessions)

Theory Paper VII ; 90 Hrs — Lab VII : 30 Hrs (15 sessions)

Theory Paper VIII (for each paper) : 90 Hrs — Lab VIII : 30 Hrs (15 sessions)

Internal Assessment

Paper I, II, III & IV:

Weightage for Internal Assessment is 40 marks.
For mid semester examinations - 20 marks
For continuous assessment – 20 marks
Two mid semester examinations will be conducted for 40 marks in the following Question Paper pattern:

Objective questions (2 mark)	: 08 -	8 x 2 =16 marks
Short answer question (6 marks)	: 04 -	4 x 6 = 24 marks (internal choice)
		40 marks

The average of two mid examination marks are to be taken for 20 marks.
For continuous assessment – 20 marks in the following way:

Assignment	-	10 marks
Seminar	-	5 marks
Viva voce exam	-	5 marks

Paper V, VI, VII & VIII:

Weightage for internal assessment is 30 marks.
For mid semester examinations - 15 marks
For continuous assessment – 15 marks
Two mid semester examinations will be conducted for 30 marks in the following Question Paper pattern:

Objective questions (1 mark)	: 10 -	10 x 1=10 marks
Short answer question (5 marks)	: 04 -	4 x 5 = 20 marks (internal choice)
		30 marks

The average of two mid examination marks are to be taken for 15 marks.
For continuous assessment – 15 marks in the following way:

Assignment	-	5 marks
Seminar	-	5 marks
Viva voce exam	-	5 marks

P.R.GOVT.COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc. MATHEMATICS-SEMESTER I (w.e.f. 2017-2018)
Course: DIFFERENTIAL EQUATIONS

Total Hrs. of Teaching-Learning: 90 @ 6 hr/Week **Total credits: 05**

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OBJECTIVES:

- To classify differential equations by order, linearity and homogeneity.
- To compute solutions to various differential equations by using analytic techniques.
- To identify the appropriate method for solving the given differential equation.
- To get awareness about the applications.

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Unit 1: Differential equations of first order and first degree **(18 hours)**
Exact differential equations, integrating factors, linear Differential equations, Differential equations reducible to linear form, Change of variables.

Unit 2: Orthogonal Trajectories, Differential equations of the first order but not of the first degree **(18 hours)**
Orthogonal Trajectories, Equations solvable for p; Equations solvable for y; Equations solvable for x; Equations that do not contain x (or y); Clairaut's equation.

Unit 3: Higher Order Linear Differential Equations (with constant coefficients) -- I **(18 hours)**

Solution of homogeneous linear differential equations of order n with constant coefficients. Solution of the non-homogeneous linear differential equations with constant coefficients $f(D)y = Q(x)$ by means of polynomial operators when $Q(x) = be^{ax}, Q(x) = b\sin ax$ or $b\cos ax$.

Unit 4: Higher Order linear differential equations (with constant coefficients) ---- II **(18 hours)**

Solution of the non-homogeneous linear differential equations with constant coefficients $f(D)y = Q(x)$ by means of polynomial operators when $Q(x) = bx^k, Q(x) = e^{ax}V, Q(x) = xV$ and $Q(x) = x^mV$.

Unit 5: Higher Order linear differential equations: (with Non constant coefficients) **(18 hours)**

Method of variation of parameters, Linear differential equations with non-constant coefficients, The Cauchy-Euler equation.

Additional Inputs:
1. Simultaneous differential equations
2. Applications of 1st order and 1st degree differential equations.
(No question to be set from this part)

Prescribed Text Books:
1. Scope as in "Differential Equations and their applications by ZafarAhsan, published by prentice-Hall of India Pvt. Ltd. New Delhi-Second edition.

Reference Books:

1. A text book of Mathematics-Volume-I published by S.Chand& Company.
2. Differential Equations bySanthiNarayana, S.Chand& Company.

BLUE PRINT FOR QUESTION PAPER PATTERN
SEMESTER-I

Unit	TOPIC	V.S.A.Q	S.A.Q	E.Q	Marks allotted
1	Differential Equations of 1st order and 1st degree	1	1	2	22
2	Orthogonal Trajectories, Differential Equations of 1st order but not of 1st degree	1	1	2	22
3	Higher Order Linear Differential Equations (with constant coefficients) - I	1	1	1	14
4	Higher Order Linear Differential Equations (with constant coefficients) - II	1	1	2	22
5	Higher Order Linear Differential Equations (with non constant coefficients)	1	1	1	14
TOTAL		5	5	8	94

V.S.A.Q = Very short answer questions (1 mark)
S.A.Q = Short answer questions (5 marks)
E.Q = Essay questions (8 marks)

Very short answer questions : 5 X 1 =05
Short answer questions : 3 X 5 =15
Essay questions : 5 X 8 =40

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Total Marks = 60

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P.R. Government College (Autonomous), Kakinada
I year B.Sc., Degree Examinations – I Semester
Mathematics Course: Differential Equations
Paper I (Model paper w.e.f.2017-2018)

Time: 2Hrs 30 min | Max. Marks: 60

PART-I

Answer ALL the questions. Each question carries 1 mark 5X1M = 5M.

1. Write the condition for a differential equation of first order to be an exact differential equation.
2. Solve $(p-x)(p-y^2)=0$.
3. Find y_c of the differential equation $(D^2+4D+4)y=3xe^{-2x}$.
4. Find the particular integral of $D^2y=x^2$.
5. In a D.E. $\frac{d^2y}{dx^2}+P\frac{dy}{dx}+Qy=R, if\ 1+P+Q=0$ then what is a part of complementary function.

PART-II

Answer any THREE questions, each question carries 5 marks. 3X5M=15M

6. Solve $(e^y+1)\cos x\,dx+e^y\sin x\,dy=0$.
7. Solve $(py+x)(px-y)=2p$.
8. Solve $\frac{d^2y}{dx^2}-\frac{dy}{dx}+2y=\sin 2x$.
9. Solve $(D^2-2D+1)y=x^2e^{3x}$.
10. Solve $(D^2-2D)y=e^x\sin x$, by the method of variation of parameters.

PART-III

Answer any FIVE questions from the following by choosing at least TWO from each section. Each question carries 8 marks. 5X8M=40M

SECTION-A

11. Solve $\left(y+\frac{y^3}{3}+\frac{x^2}{2}\right)dx+\frac{1}{4}(x+xy^2)dy=0$.
12. Solve $(1+y^2)dx=(\tan^{-1}y-x)dy$.
13. Solve $y^2\log y=xpy+p^2$.
14. Find the orthogonal trajectories of the family of curves $x^{\frac{2}{3}}+y^{\frac{2}{3}}=a^{\frac{2}{3}}$, where '$a$' is a parameter.

SECTION-B

15. Solve $(D^2-4D+3)y=\sin 3x.\cos 2x$
16. Solve $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+13y=8e^{3x}\sin 2x$.
17. Solve $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=xe^x\sin x$.
18. Solve $x^2y''-2x(1+x)y'+2(1+x)y=x^3$.

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.SC. – MATHEMATICS - SEMESTER II (w.e.f. 2017-2018)

Course: SOLID GEOMETRY

Total Hrs. of Teaching-Learning: 90 @ 6 h / Week **Total Credits: 05**

Objective:

- To get awareness about the three dimensional geometry along with visualization.
- To be able to apply 3-D geometry for the construction.

Unit 1: The Plane **(18 h)**

Equation of plane in terms of its intercepts on the axes, Equation of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

Unit 2: The Straight Line **(18 h)**

Equation of a line; Angle between a line and a plane; the condition that a given line may lie in a given plane, the condition that the given lines are coplanar, Number of arbitrary constants in the equations of straight line; sets of conditions which determine a line; The shortest distance between two lines, the length and equations of the line of shortest distance between two straight lines, length of the perpendicular from a given point to a given line.

Unit 3: The Sphere **(18h)**

Equation of the sphere. Plane section of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line; Tangent lines and tangent planes; plane of contact, Polar plane conjugate points; conjugate planes.

Unit 4: The Sphere and the Cone **(18h)**

Angle of intersection of two spheres; condition for two spheres to be orthogonal; Radical plane. Coaxial system of spheres; simplified form of the equation of two spheres.

Definition of a cone, vertex, guiding curve generators; Equation of the cone with a given vertex and guiding curve; Equation of cone with vertex at origin is homogeneous; Condition that thegeneral equation of the second degree should represent a cone.

Unit 5: The Cone **(18 h)**

Enveloping cone of a sphere;Right Circular Cone; Conditions that a cone may have three mutually perpendicular generators; Intersection of a line and quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone;Reciprocal cones; Intersection of two cones with a common vertex.

Additional Inputs:

1. Intersection of three planes; Triangular prism.
2. The right circular cylinder.

Prescribed Book:

Scope as in "A text book of Mathematics for B.Sc. volume I" by V.Krishna Murthy & others, S.Chand and Co. .ltd.

ReferenceBooks:

1. Analytical Solid Geometry by Shanti Narayan and P.K.Mittal, published by S.Chand & Company Ltd. Seventh edition.

2. A text book of Analytical Geometry of Three Dimensions by P.K.Jain and Khaleel Ahmed, Wiley Eastern Ltd., 1999.

3. Course on Solid Geometry by N.P.Bali-Golden series publications.

BLUE PRINT FOR QUESTION PAPER PATTERN
SEMESTER-II

Unit	TOPIC	V.S.A.Q	S.A.Q	E.Q	Marks allotted to the Unit
1	The Plane	1	1	2	22
2	The Right Line	1	1	2	22
3	The Sphere	1	1	1	14
4	The Sphere & The Cone	1	1	2	22
5	The Cone	1	1	1	14
TOTAL		5	5	8	94

V.S.A.Q = Very short answer questions (1 mark)
S.A.Q = Short answer questions (5 marks)
E.Q = Essay questions (8 marks)

Very short answer questions : 5 X 1 =05
Short answer questions : 3 X 5 =15
Essay questions : 5 X 8 =40

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Total Marks = 60

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P.R.Government College (Autonomous), Kakinada
I year B.Sc., Degree Examinations - II Semester
Mathematics Course: Solid Geometry
Paper II (Model Paper w.e.f. 2017 - 2018)

Time: 2Hrs 30 min

Max. Marks: 60

PART-I

Answer ALL the questions. Each question carries 1 mark. 5 X 1M= 5 M

1. Find the equation of the plane through the line of intersection of $x - 3y + 2z + 3 = 0,\ 3x - y - 2z - 5 = 0$ and the origin.
2. Find the equation of the line passing through $(4,3,-7)$ and equally inclined to the axes.
3. Find the centre of the sphere $x^2 + y^2 + z^2 - 3x + 5y - 4z - 3 = 0$.
4. Find the polar plane of the point (0, -1, 1) with respect to the sphere
$$x^2 + y^2 + z^2 - 2x + 4y + 6z - 11 = 0.$$
5. Write the reciprocal cone of $9x^2 + 4y^2 - 7z^2 = 0$.

PART –II

Answer any THREE questions, each question carries 5 marks. 3 X 5M= 15 M

6. Find the equation of the plane through the point (-1,3,2) and perpendicular to the two planes $x + 2y + 2z = 5$ *and* $3x + 3y + 2z = 8$.
7. Find the image of the point $A(1,3,4)$ in the plane $2x - y + z + 3 = 0$.
8. Find the equation of the sphere through the origin and making intercepts a,b,c with the axes.
9. If r_1 and r_2 are the radii of the orthogonal spheres, then find the radius of the circle of their intersection.
10. Find the equation of the enveloping cone of the sphere $x^2 + y^2 + z^2 + 2x - 2y = 2$, with its vertex at (1,1,1).

PART-III

Answer any FIVE questions from the following by choosing at least TWO from each section. Each question carries 8 marks. 5 X 8M = 40M

SECTION -A

11. Find the planes bisecting the angles between the angles between the planes $2x - y + 2z + 3 = 0$ *and* $3x - 2y + 6z + 8 = 0$. Point out which of the planes bisects the acute angle and which bisects the obtuse angle in which the origin lies.
12. Show that the equation $x^2 + 4y^2 + 9z^2 - 12yz - 6zx + 4xy + 5x + 10y - 15z + 6 = 0$ represents a pair of parallel planes and find the distance between them.
13. Prove that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$; $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ are coplanar. Also find their point of intersection and the plane containing the lines.

14. Find the length and equations of shortest distance between the lines
$$\frac{x-2}{2}=\frac{y-2}{3}=\frac{z-3}{4}\ and\ \frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}.$$

SECTION –B

15. Show that the four points (-8,5,2), (-5,2,2),(-7,6,6),(-4,3,6) are concyclic.
16. Find the equation of the sphere which touches the plane $3x + 2y - z + 2 = 0$ at $(1, -2, 1)$ and cuts orthogonally the sphere$x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$.
17. Prove that the plane $ax + by + cz = 0$ cuts the cone $yz + zx + xy = 0$ in a perpendicular lines if $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$.
18. Find the equation to the right circles cone whose vertex in $P(2, -3,5)$ axis PQ which makes equal angles with the axis and which passes through (1,-2,3).

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P.R.GOVT.COLLEGE (AUTONOMOUS), KAKINADA

II B.SC. – MATHEMATICS - Semester- III (w.e.f. 2017-2018)

Course: ABSTRACT ALGEBRA

Total Hrs. of Teaching-Learning: 90 @ 6 h / Week **Total Credits: 05**

Objective:

- To learn about the basic structure in Algebra
- To understand the concepts and able to write the proofs to theorems
- To know about the applications of group theory in real world problems

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Unit 1: Groups **(20 hours)**

Binary Operation – Algebraic structure – semi group – monoid –Definition and elementary properties of a Group – Finite and Infinite groups – Examples – Order of a group – Composition tables with examples.

Unit 2: Subgroups, Cosets and Lagrange's Theorem **(20hours)**

Definition of Complex – Multiplication of two complexes – Inverse of a complex – Subgroup definition – examples - criterion for a complex to be a subgroup –criterion for the product of two subgroups to be a subgroup – union and intersection of subgroups.

Cosets definition – properties of cosets – Index of subgroup of a finite group – Lagrange's Theorem.

Unit 3: Normal Subgroups **(17 hours)**

Definition of normal subgroup – proper and improper normal subgroup – Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – subgroup of index 2 is a normal subgroup – simple group – quotient group – criteria for the existence of a quotient group.

Unit 4: Homomorphism **(16 hours)**

Definition of homomorphism – Image of homomorphism – elementary properties of homomorphism – Definition and elementary properties of Isomorphism and automorphism – Kernel of a homomorphism – Fundamental theorem on homomorphism and applications.

Unit 5: Permutations and Cyclic groups **(17 hours)**

Definition of permutation – permutation multiplication – Inverse of a permutation – Cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Definition of cyclic group - elementary properties – classification of cyclic groups.
Additional Inputs : Applications of group theory

Text Book:
Abstract Algebra by J.B.Fraleigh

Books for reference:

1 A text book of Mathematics, S.Chand and Co.
2. Modern Algebra by Gupta and Malik
3 Elements of Real Analysis by Santhi Nararayana & M.D.Raisinghania.

BLUE PRINT FOR QUESTION PAPER PATTERN

SEMESTER-III

Unit	TOPIC	V.S.A.Q	S.A.Q	E.Q	Marks allotted to the Unit
1	Groups	1	1	2	22
2	Subgroups, Cosets & Lagrange's theorem	1	1	2	22
3	Normal Subgroups	1	1	1	14
4	Homomorphism	1	1	1	14
5	Permutations and Cyclic groups	1	1	2	22
Total		5	5	8	94

V.S.A.Q = Very short answer questions (1 mark)
S.A.Q = Short answer questions (5 marks)
E.Q = Essay questions (8 marks)

Very short answer questions : 5 X 1 =05
Short answer questions : 3 X 5 =15
Essay questions : 5 X 8 =40

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Total Marks = 60

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P.R.Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations - III Semester
Mathematics Course: Abstract Algebra
Paper III (Model Paper w.e.f. 2018 - 2019)

Time: 2Hrs 30 min Max. Marks: 60

PART –I

Answer the following questions. Each question carries 1 mark. 5x1M = 5 M

1. Write the Cauchy's composition table for $G = \{1, \omega, \omega^2\}$.
2. Write a proper subgroup of a group $G = \{1, -1, i, -i\}$ with respect to multiplication.
3. Define normal subgroup.
4. Check whether $f: (Z, +) \longrightarrow (Z, +)$ defined by $f(x) = x^2$ is a homomorphism or not.
5. Write the inverse of the permutation $f = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 4 & 3 & 1 & 2 & 5 \end{pmatrix}$.

PART-II

Answer any THREE questions, each question carries 5 marks. 5x5M=25 M

6. Prove that the set Z of all integers form an abelian group w.r.t. the operation defined by $a * b = a + b + 2 \; \forall \; a, b \in Z$.
7. Prove that a non empty complex H of a group G is a subgroup of G if and only if $H = H^{-1}$.
8. If M, N are two normal subgroups of G such that $M \cap N = \{e\}$ then every element of M commutes with every element of N.
9. If f is a homomorphism of a group G into a group G', then prove that the kernel of f is a normal subgroup of G.
10. Express the product $(2 \;\; 5 \;\; 4)(1 \;\; 4 \;\; 3)(2 \;\; 1)$ as a product of disjoint cycles and find its inverse.

PART-III

Answer any FIVE questions from the following by choosing at least TWO from each section. Each question carries 8 marks. 5x8M=40 M

SECTION-A

11. Show that the n^{th} roots of unity form an abelian group with respect to multiplication.
12. Prove that a semi group $(G, .)$ is a group if and only if the equations $ax = b, ya = b \; \forall \; a, b \in G$ have unique solutions in G.
13. State and Prove the necessary and sufficient condition for a finite complex H of a group G to be a subgroup of G.
14. Prove that the union of two subgroups of a group is a subgroup if and only if one is contained in the other.

SECTION-B

15. If H is a normal subgroup of a group (G, .) then prove that the product of two right (left) cosets of H is also a right (left) coset of H.
16. Prove that every homomorphic image of a group G is isomorphic to some quotient group of G.
17. Prove that the set A_n of all even permutations form a normal subgroup of the group of permutations S_n.
18. Prove that every subgroup of a cyclic group is cyclic.

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P.R.GOVT.COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc. MATHEMATICS-Semester IV (w.e.f. 2017-2018)
Course: Real Analysis

Total Hrs. of Teaching-Learning: 90 @ 6 hr/Week **Total credits: 5**

OBJECTIVES:

- Be able to understand and write clear mathematical statements and proofs.
- Be able to apply appropriate method for checking whether the given sequence or series is convergent.
- Be able to develop students ability to think and express themselves in a clear logical way.
- This curriculum gives an opportunity to learn about the derivatives of functions and its applications.

(18 hours)

Unit 1: Real Number System and Real Sequence

The algebraic and order properties of R – Absolute value and Real line – completeness property of R – applications of supreme property – intervals -Limit point of a set, Existence of limit points. (No questions to be set from this portion)

Sequences and their limits – Range and Boundedness of sequences - Necessary and sufficient condition for convergence of Monotone sequence, limit point of a sequence, Subsequences and the Bolzano Weierstrass theorem - Cauchy sequences – Cauchy's general principle of convergence theorems.

(18 hours)

Unit 2: Infinite Series

Introduction to Infinite Series – convergence of series –Cauchy's general principle of convergence for series – Tests for convergence of nonnegative terms – p- test – limit comparision test – Cauchy's nth root test - De-Alambert's ratio test - alternating series – Liebnitz's test -absolute and conditional convergence.

(18 hours)

Unit 3: Limits and Continuity

Real valued functions – Boundedness of a function - Limit of a Function, One-sided Limits- Right hand and Left Hand Limits - Limits at Infinity - Infinite Limits.(**no question to be set**) Continuous Functions- Discontinuity of a Function - Algebra of Continuous Functions – Continuous functions on intervals - Some Properties of Continuity of a function at a point - Uniform Continuity.

(18 hours)

Unit 4: Differentiation and Mean Value Theorem

The Derivability of a function, on an interval, at appoint, Derivability and Continuity of a function - Geometrical meaning of the Derivative - Mean Value Theorems - Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean Value theorem.

(18 hours)

Unit 5: Riemann Integration

Riemann sums, Upper and Lower Riemann integrals, Riemann integral, Riemann Integrable function – Darboux's Theorem - Necessary and sufficient conditions for Riemann integrability – properties of integrable functions – Fundamental Theorem of Integral Calculus – Integral as the limit of a sum – Mean Value Theorems.

Additional Inputs :

1. problems using cauchy's first theorem on limits and cauchy's second theorem on limits.
2. Statement of Maclaurin's theorem and expansions of $e^x, \sin x, \cos x, \log(1+x)$.

Prescribed book:

- Real Analysis by Rabert & Bartely and D.R.Sherbart, published by John Wiley.

Reference books:

- Elements of Real Analysis by Santhi Nararayan & M.D.Raisinghania, published by S.Chand& Company Pvt. Ltd., New Delhi.
- Course on Real analysis by N.P.Bali-Golden series publications
- A Text Book of Mathematics Semester IV by V.Venkateswarrao & others, published by S.Chand& Company Pvt. Ltd., New Delhi

BLUE PRINT FOR QUESTION PAPER PATTERN

SEMESTER-IV

Unit	TOPIC	V.S.A.Q	S.A.Q	E.Q	Marks allotted
1	Real Number System and Real Sequence	1	1	1	14
2	Infinite Series	1	1	2	22
3	Limits and Continuity	1	1	1	14
4	Differentiation and Mean Value Theorem	1	1	2	22
5	Riemann Integration	1	1	2	22
	TOTAL	5	5	8	94

V.S.A.Q = Very short answer questions (1 mark)
S.A.Q = Short answer questions (5 marks)
E.Q = Essay questions (8 marks)

Very short answer questions : 5 X 1 = 05
Short answer questions : 3 X 5 = 15
Essay questions : 5X 8 = 40

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Total Marks = 60

P.R.Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations - IV Semester
Mathematics Course : Real Analysis
Paper–IV (Model Paper w. e. f. 2018-2019)

Time: 2Hrs 30 min Max. Marks: 60

PART-I

Answer ALL the questions. Each question carries 1 mark. 5 x 1M = 5 M

1. Define convergence of a sequence.
2. Test the convergence of $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\cdots$.
3. Define continuity of a function at a point $'a'$.
4. Give an example of a function which is continuous but not derivable.
5. Evaluate $\lim_{n\to\infty}\frac{1}{n}[e^{\frac{3}{n}}+e^{\frac{6}{n}}+e^{\frac{9}{n}}+\cdots+e^{\frac{3n}{n}}]$

PART -II

Answer any THREE questions each question carries 5 marks. 3 x 5M = 15 M

6. Show that $\lim_{n\to\infty}\left[\sqrt{\frac{1}{n^2+1}}+\sqrt{\frac{1}{n^2+2}}+\cdots+\sqrt{\frac{1}{n^2+n}}\right]=1.$
7. State and Prove Leibnitz's test.
8. Examine for continuity the function f defined by $f(x) = |x|+|x-1|$ at 0, 1.
9. Show that every derivable function on a closed interval is continuous.
10. State and prove fundamental theorem of Integral Calculus

PART-III

Answer any FIVE questions from the following by choosing at least TWO from each section. Each question carries 8 marks. 5x8M=40M

SECTION –A

11. Prove that every monotonically increasing sequence which is bounded above converges to its least upper bound.
12. State and Prove Cauchy's nth root test for the convergence of series.
13. Examine the convergence of $\sum_{n=1}^{\infty}\left(\sqrt{n^3+1}-\sqrt{n^3}\right)$.
14. Prove that every continuous function is bounded and attains its bounds.

SECTION-B

15. State and prove Rolle's theorem
16. Using Legrange's Mean Value Theorem prove that $1+x<e^x<1+xe^x,\ \forall x>0$
17. Prove that f(x) = sin x is integrable on $[0,\frac{\pi}{2}]$ and $\int_0^{\frac{\pi}{2}}\sin x\,dx=1$
18. State the first mean value theorem of integral calculus and by using it prove that $\frac{\pi^3}{24}\le\int_0^{\pi}\frac{x^2}{5+3\cos x}\,dx\le\frac{\pi^3}{6}$.

P.R.GOVT.COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc./BA/B.COM - Semester IV (w.e.f 2017-2018)

Course: ANALYTICAL SKILLS

Total Hrs. of Teaching-Learning: 30@ 2 hr/Week **Total credits: 02**

Objectives:

- To impart the knowledge of arithmetic and reasoning.
- To built up confidence for writing competitive examinations.

UNIT – 1

Data Analysis:-The data given in a Table – Graph - Bar Diagram - Pie Chart - Venn diagram or a passage is to be analyzed and the questions pertaining to the data are to be answered. (6 hrs)

UNIT – 2

Sequence and Series:- Analogies of numbers and alphabets - completion of blank spaces following the pattern in A:b::C: d relationship - odd thing out - Missing number in a sequence or a series. (6 hrs)

UNIT - 3

Arithmetic ability:-Algebraic operations- BODMAS – Fractions - Divisibility rules- LCM&GCD (HCF) - Date, Time and Arrangement Problems; Calendar problems, Clock problems, Blood Relationship. (6 hrs)

UNIT - 4

Quantitative aptitude:- Averages - Ration and proportion - Problems on ages - Time-distance – speed. (6 hrs)

UNIT – 5

Business computations:- Percentages - Profit &loss-Partnership - simple and compound interest. (6 hrs)

Reference Books:

1. Quantitative Aptitude for Competitive Examination by R S Agrawal, S.Chand publications

BLUE PRINT FOR QUESTION PAPER PATTERN
SEMESTER-IV
ANALYTICAL SKILLS

UNIT	**TOPIC**	**V.S.A.Q** Multiple choice (1 Mark)	**S.A.Q** (3 Marks)	**E.Q** (5 Marks)	
1	Data Analysis	-	-	2	10
2	Sequence and Series	10	-	-	10
3	Arithmetic ability	-	3	2	19
4	Quantitative aptitude	-	2	2	16
5	Business computations	-	3	2	19
	TOTAL MARKS				74.

V.S.A.Q = Very short answer questions (1 mark)
S.A.Q = Short answer questions (3 marks)
E.Q = Essay questions (5 marks)

Very short answer questions : 10X 1 = 10
Short answer questions : 05X 3 = 15
Essay questions : 05X 5 = 25

....

Total Marks = 50

P.R.Government College (Autonomous), Kakinada

II B.Sc./BA/B.Com. Degree Examination –Semester- IV

ANALYTICAL SKILLS

Model Paper (w.e.f. 2017-2018)

Time: 2 Hrs — Total Marks: 50M

SECTION- A

Answer all questions. Each question carries 1 Mark. — 10 x 1 = 10M

1. Missing number in the series is---------. ( )
   1, 9, 25 ,49 ,? ,121
   a) 64 b)81 c)91 d)100
2. Missing number in the series is---------. ( )
   4. 10,18,28,40,54.70,?
   a) 85 b)86 c)87 d)88
3. . The wrong number in the series is -------------. ( )
   8,13,21,32,47,63,83
   a) 13 b)21 c)32 d)47
4. Missing Alphabet in the series is -------------. ( )
   T ,R ,P ,N ,L ,?,?
   a) F b)J,H c)K,H d)K,L
5. Missing Alphabet in the series is -------------.
   AB,DEF,HIJK,?,STUVWX ( )
   a) *LMNO* b) *LMNOP* c) *MNOPQ* d) *QRSTU*
6. Missing term in the series is ----------------- . ( )
   D-4,F-6,H-8,J-10 ,? ,?
   a) K-12,M-13 b)L-12,M-14 c)L-12,N-14 d)K-12M-14
7. Missing Latter in the Series is -------------- ( )
   _ _ aba _ _ ba _ab
   a) *abbba* b) *abbab* c) *baabb* d) *)bbaba*
8. Find relation ship between the words ( )
   Botany : Plants : : Entomology : ?
   a) *Snakes* b) *nsects* c) *)Birds* d) *Germs*
9. Find relation ship between the words is ( )
   Needle is related to Thread in the same way as Pen is related to ?
   a) *Ink* b) *Cap* c) *Paper* d) *Word*
10. Find relation ship between the numbers is ( )
    18: 3 0 :: 36 : ?
    a) 54 b)62 c)64 d)66

SECTION - B

Answer any FIVE of the following questions. Each question carries 3 marks. 5 x 3 = 15M

11. Find the value of $\frac{(6+6+6+6)\div 6}{4+4+4+4\div 4}$

12. If the number 517*324 is completely divisible by 3, then the smallest whole number in Place of * will be.

13. A is B's sister. C is B's mother. D is C's father. E is D's mother. Then, how is A related to D?

14..If A : B = 2 : 3 B : C = 4 :7 then find A : B : C =?

15. The average of four consecutive even numbers is 27. Find the largest of these Numbers.

16. What is 25% of 25% equal to?

17. A man buys a cycle for Rs.1400 and sells it at a loss of 15%. What is the selling price of the cycle?

18. Find the simple interest on Rs 7500 in 4 years at 15%

SECTION - C

Answer any FIVE of the following questions. Each question carries 5 mark 5 x 5 = 25 M

19. DIRECTIONS: Study the table carefully to answer the questions that follow:

Maximum and minimum Temperature(in degree Celsius) recorded on first day of each month for five different cities.

Month	Temperature									
	Bhuj		Sydney		Ontario		Kabul		Beijing	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1st sep	24	14	12	2	5	1	34	23	12	9
1st oct	35	21	5	-1	15	6	37	30	9	3
1st nov	19	8	11	3	4	0	45	36	15	1
1st dec	9	2	-5	-9	-11	-7	31	23	2	-3
1st jan	-4	-7	-11	-13	-14	-19	20	11	5	-13

1 .What is the difference between the max temperature of Ontario on 1st Nov and the min temperature of Bhuj on 1st Jan?

(1) 3 ℃ (2) 18 ℃ (3) 15 ℃ (4) 9 ℃ (5) 11℃

2 . In which month respectively the max temperature of Kabul is 2^{nd} highest and min temperature of Sydney is highest ?

(1) 1^{st}oct& 1^{st}jan (2) 1^{st}oct& 1^{st}nov (3) 1^{st}dec& 1^{st}jan (4) 1^{st}sept& 1^{st}jan (5) 1^{st}dec& 1^{st} Sept

3. In which month on 1^{st} day is the difference between the max temperature & min temperature of Bhuj second highest ?

(1) 1^{st}sept (2) 1^{st}oct (3) 1^{st}nov (4) 1^{st}dec (5) 1^{st}jan

4. What is the averagemaximum temperature of Beijing over all the months together.

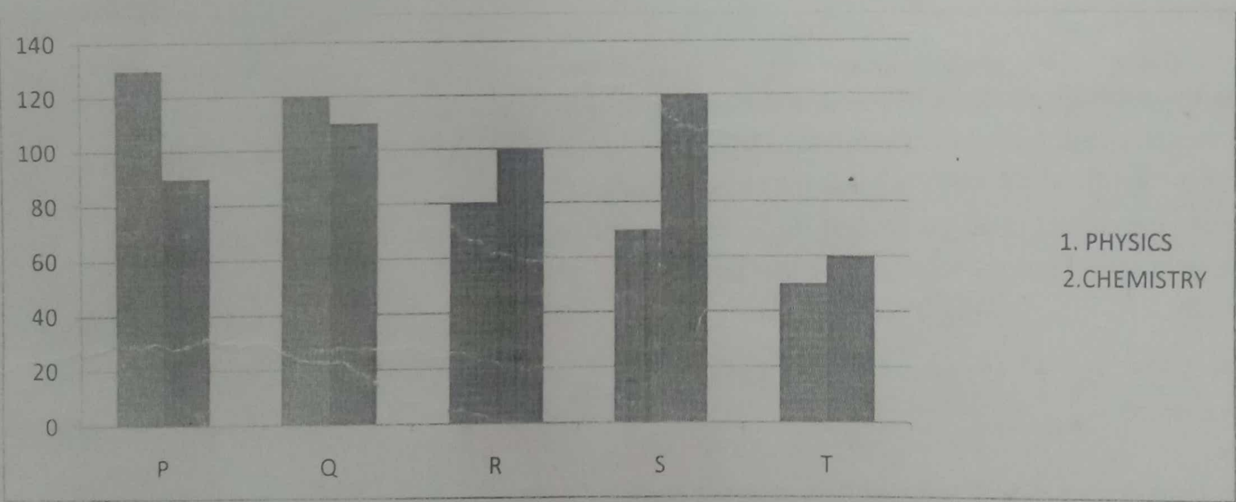
(1) 8.4℃ (2) 9.6℃ (3) 7.6℃ (4) 9.2℃ (5) 8.6℃

5. What is the respective ratio between the min temperature of Beijing on 1^{st}sept& the max temperature of Ontario on 1^{st}oct ?

(1) 3:4 (2) 3:5 (3) 4:5 (4) 1:5 (5) 1:4

20. Study the following bar graphs carefully to answer these questions

Marks obtained by 5 students in physics & chemistry



1. Marks obtained by S in chemistry is what percent of the total marks obtained by all the students in chemistry ?

   (1)25 (2)28.5 (3)35 (4)31.5 (5)22

2. If the marks obtained by T in physics were increased by 14% of the original marks, what would be his new approximate % in physics if the max marks in physics were 140?

   (1)57 (2)32 (3)38 (4)48 (5)41

3. Fill in the blank space in order to make the sentence correct as per the given information. Total marks obtained by T in both the subjects together is more than the marks obtained by
(1) Q in chemistry (2) R in physics (3) S in chemistry (4) P in physics
(5) R in both the subjects together

4. What is the respective ratio between the total obtained by P in physics & chemistry together to the total marks obtained by Tin physics & chemistry together ?
(1) 3:2 (2) 4:3 (3) 5:3 (4) 2:1 (5)None of these

5. What is the respective ratio between the total marks obtained by Q &S together in chemistry to the total marks obtained by P & R together in physics?
(1)23:25 (2)23:21 (3)17:19 (4)17:23 (5) none of these

21. The H.C.F. of two numbers is 11 and their L.C.M. is 693. If one of the numbers is 77, then Find the other

22. A clock is set right at 8 a.m. The clock gains 10 minutes in 24 hours, what will be the true time when the clock indicates 1 p.m. on the following day?

23. If $\frac{1}{5}:\frac{1}{x}::\frac{1}{x}:\frac{1}{125}$, then the value of x is?

24. How many minutes does Aditya take to cover a distance of 400m, if he runs at a speed of 20 km/hr?

25. Sanjay and Raju started a business and invested Rs.20000 and Rs.25000 respectively. After 4 months Raju left and Naresh joined by investing Rs.15000.At the end of the year there was a profit of Rs.4600. what is the share of Naresh?

26. Meena purchased two fans each at Rs.1200. She sold one fan at the loss of 5% and other at the gain 10%.Find the total gain or loss percent?

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P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF MATHEMATICS AND STATISTICS
QUESTION BANK FOR ANALYTICAL SKILLS
UNIT-1 DATA ANALYSIS

TABLE &GRAPHS

1. DIRECTIONS: Study the table carefully to answer the questions that follow:

Maximum and minimum Temperature(in degree Celsius) recorded on first day of each month for five different cities.

Month	Temperature									
	Bhuj		Sydney		Ontario		Kabul		Beijing	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1st sep	24	14	12	2	5	1	34	23	12	9
1st oct	35	21	5	-1	15	6	37	30	9	3
1st nov	19	8	11	3	4	0	45	36	15	1
1st dec	9	2	-5	-9	-11	-7	31	23	2	-3
1st jan	-4	-7	-11	-13	-14	-19	20	11	5	-13

Q:1 What is the difference between the max temperature of Ontario on 1st nov and the min temperature of Bhuj on 1st jan?

(2) 3 ℃ (2) 18 °C (3) 15 ℃ (4) 9 ℃ (5) 11℃

ANS: (5) Required difference = 4-(-7)=4+7=11

2: In which month respectively the max temperature of Kabul is 2nd highest and min temperature of Sydney is highest ?

(2) 1st oct& 1st jan (2) 1st oct& 1st nov (3) 1st dec& 1st jan (4) 1st sept& 1st jan (5) 1st dec& 1st Sept

ANS: (1)

3: In which month on 1st day is the difference between the max temperature & min temperature of Bhuj second highest ?

(2) 1st sept (2) 1st oct (3) 1st nov (4) !st dec (5) 1st jan

ANS: (3) Temperature difference of Bhuj :

1st Sept 24-14=10℃, 1st Nov 19-8=11℃, 1st Oct 35-21=14℃, 1st Dec 9-2=7℃

1st Jan -4+7=3℃

4. What is the average maximum temperature of Beijing over all the months together.

(2) 8.4℃ (2) 9.6℃ (3) 7.6℃ (4) 9.2℃ (5) 8.6℃

ANS: (5) Max temperature =12+9+15+2+5/5 = 43/5=8.6℃

5. What is the respective ratio between the min temperature of Beijing on 1st sept& the max temperature of Ontario on 1st oct ?

(1) 3:4 (2) 3:5 (3) 4:5 (4) 1:5 (5) 1:4

ANS: required ratio=9:15=3:5

2. Study the following table carefully answer the questions percentage of marks obtained by 6 students in 6 different subjects

Sub/student	History (out of 50)	Geography (out of 50)	Maths(out of 150)	Science(out of 100)	English (out of 75)	Hindi (out of 75)
Amit	76	85	69	73	64	88
Bharat	84	80	85	78	73	92
Umesh	82	67	92	87	69	76
Nikhil	73	72	78	69	58	83
Pratiksha	68	79	64	91	66	65
Ritesh	79	87	88	93	82	72

1. What is the approximately the integral % of marks obtained by umesh in all the subjects ?
(1) 80% (2) 84% (3) 86% (4)78% (5) 77%

ANS: (1) total marks obtained by Umesh

=41+33.5+92/100*150+87+69100*75+76/100*5

=41+33.5+138+87+51.75+57=408.25

Required % = 408/500*100=80%

2. What is the avg % of marks obtained by all the students in hindi (approximated to two places of decimal)
(1) 77.45% (2) 79.33% (3) 75.52% (4) 73.52% (5) none of these

ANS: (2) required avg of % in hindi =88+92+76+83+65+72/6=476/6=79.33%

3. What is the avg marks of all the students in Mathematics ?
(1) 128 (2) 112 (3)118 (4) 138 (5) 144

ANS: (3) avg mark in mathematics= 15.

(69+85+92+78+64+88)/100*6=150*476/100*6=119

4. What is the avg marks obtained by all the students in geography ?
(1) 38.26 (2) 37.26 (3)37.16 (4) 39.16 (5) None of these

ANS: (4) Average marks in geography

=50(85+80+67+72+79+87)/6*1/100=50*470/6*1/100=39.16

5. What are the total marks obtained by pratiksha in all the subjects taken together ?
(1) 401.75 (2)410.75 (3)402.75 (4)420.75 (5) none of these

ANS: (5) marks obtained by

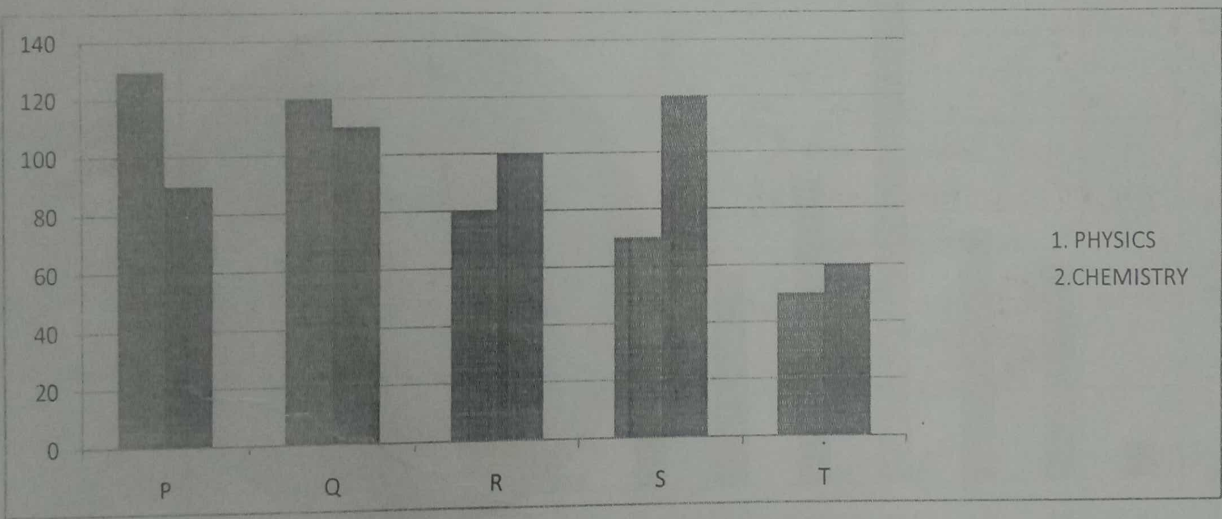
Ritesh=50*68/100+50*79/100+150*64/100+91+75*66/100+50*86/100+75*65/100

=34+39.5+96+91+49.5+48.75=358.75

BAR GRAPHS

1.Study the following bar graphs carefully to answer these questions

Marks obtained by 5 students in physics & chemistry



1. Marks obtained by S in chemistry is what percent of the total marks obtained by all the students in chemistry ?

(1)25 (2)28.5 (3)35 (4)31.5 (5)22

ANS: (1) required %=120/90+110+100+120+60*100=120/480*100=25%

2. If the marks obtained by T in physics were increased by 14% of the original marks, what would be his new approximate % in physics if the max marks in physics were 140?

(1)57 (2)32 (3)38 (4)48 (5)41

ANS: (5) increase in marks in physics of T=50*1.14=57

Required %= 57/140*100=40.7=41

3. What is the respective ratio between the total obtained by P in physics & chemistry together to the total marks obtained by T in physics & chemistry together ?

(1) 3:2 (2) 4:3 (3) 5:3 (4) 2:1 (5)None of these

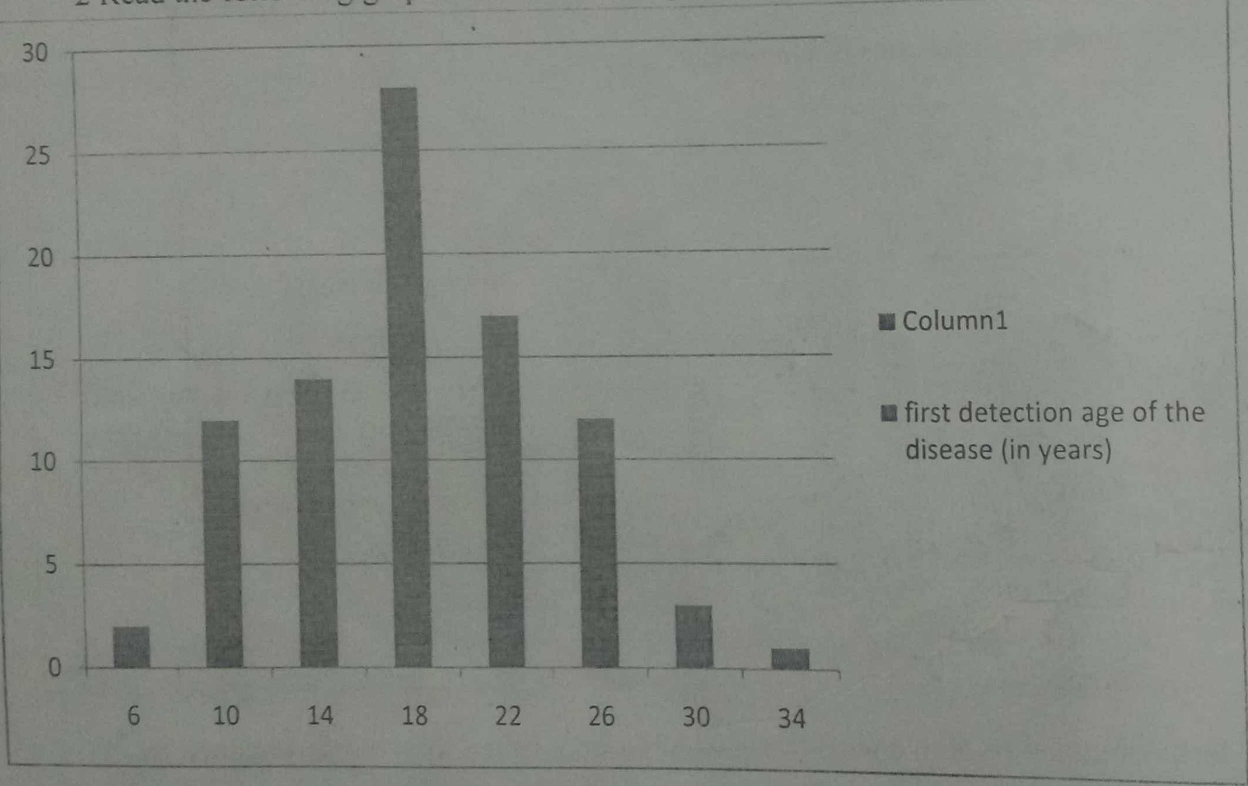
ANS: (4) required ratio=130+90/60+50=220/110=2:1

4. What is the respective ratio between the total marks obtained by Q &S together in chemistry to the total marks obtained by P & R together in physics?

(1)23:25 (2)23:21 (3)17:19 (4)17:23 (5) none of these

ANS: (2) marks obtained by Q & S in chemistry=110+120=230
Marks obtained by P & R in physics=130+80=210
Required ratio=230/210=23:21

2 Read the following graph and answer the questions.



1. The avg age of first detection of the disease (in years) is
(1)18.25 (2)19 (3)20 (4)18.45 (5) none of these

ANS: (3)

2. Max number of patients are susceptible to the disease at the age (in years) of

(1)12 (2)18.45 (3)18 (4)20 (5)none of these

ANS: (3) it is clear from the graph

3.How many patients, below 20 years of age, were suffering from the disease ?

(1)54 (2)16 (3)25 (4)72 (5) none of these

2. Advertisement charges are less than royalty by

(1) 20% (2)25% (3)10% (4)15% (5) none of these

ANS: (1) required %=20-16/20*100=20%

3. If the cost of printing is 19,500/-, the royalty is

(1) 10,400/- (2) 13,000/- (3) 9,100/- (4) 10,000/- (5) none of these

ANS: (2) cost of royalty=19500/3*2=13000/-

4. The central angle of the sector for the cost of paper is

(1) 57.6° (2) 72° (3) 50.4° (4)54° (5) none of these

ANS: (4) required angle=15/100*360°=54°

5. If the cost of paper is 5000/-, then total cost excluding advertisement charges and royalty is

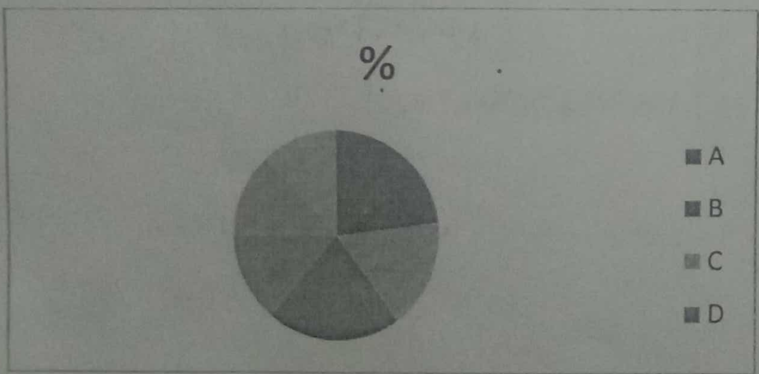
(1)24,666*2/3 /- (2)36,000/- (3)12,000/- (4)16,667/- (5) none of these

ANS: (5) required cost=5000/15*64=64000/3=Rs. 21333*1/3

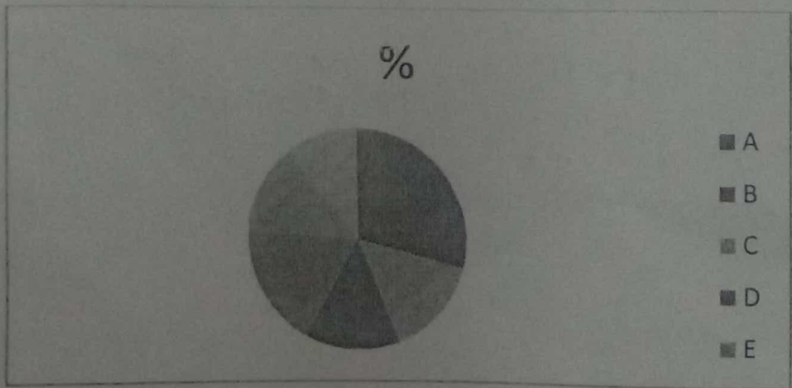
2.Percentage wise distribution of students studying in arts and commerce in 7 different institutions

Different institutions- A, B, C, D, E, F & G

Total number of students studying arts=3800.



Total number of students studying commerce=4200



1. What is the total number of students studying arts in institutes A & G to gether ?

(1)1026 (2)1126 (3)226 (4)1206 (5)1306

ANS: (1) required answer=3800*27/100=1026

2. How many students from institute B study arts &commerce ?

(1)1180 (2)1108 (3)1018 (4)1208 (5)1408

ANS: required answer=3800*8/100+4200*17/100=304+714=1018

3. The respective ratio between the number of students studying arts & commerce from institute E

(1)27:14 (2)19:27 (3)19:16 (4)19:28 (5)none of these

ANS: (2) required ratio=3800*14/100:4200*18/100=38*14:42*18=19:27

4. The ratio between the number of students studying arts from institute E to that of students studying commerce from institute D is

(1)12:17 (2)12:7 (3)19:21 (4)17:19 (5) none of these

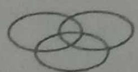
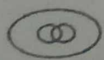
ANS: (3) required ratio=3800*14/100:4200*14/100=19:21

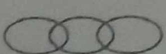
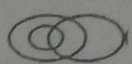
5. How many students from institutions B & D together study commerce ?
(1) 1320 (2)1302 (3)1202 (4)1220 (5) none of these

ANS: (2) required answer=4200*17/100+4200*14/100=714+588=1302

VENN DIAGRAM

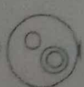
1. Which of the following Venn- diagram correctly illustrates the relation ship among the classes : *Tennis fans. Cricket players, Students*

1)  2) 

3)  4) 

2. In a dinner party both fish and meat were served. Some took only fish and Some only meat. There were some vegetarians who did not accept either. The rest accepted both fish and meat. Which of the following Venn-diagrams correctly reflects this situation?

1)  2) 

3)  4) 

UNIT-2

I In each of the following questions, a number series is given with one term missing. Choose the correct alternative that will continue the same pattern and replace the question mark in the given series.

1. 1,9,25,49,?,121

a)64 b)81 c)91 d)100 ( )

2. 11,13,17,19,23,25,?

a)26 b)27 c)29 d)37 ( )

3. 6,11,21,36,56,?

a)42 b)51 c)81 d)91 ( )

4. 10,18,28,40,54.70,?

a)85 b)86 c)87 d)88 ( )

5. 22,24,28,?,52,84

a)36 b)38 c)42 d)46 ( )

6. 28,33,31,36,?,39

a)32 b)34 c)38 d)40 ( )

7. 6,17,39,72,?

a)83 b)94 c)116 d)127 ( )

8. 325,259,204.160,127,105,?

a)94 b)96 c)98 d)100 ( )

II In each of the following questions, one term in the number series is wrong. Find out the wrong term

1.3,10,27,4,16,64,5,25,105.

a)3 b)4 c)10 d)27 ( )

2. 8,13,21,32,47,63,83

a)13 b)21 c)32 d)47 ( )

3. 105,85,60,30,0,-45,-90

a)105 b)60 c)0 d)-45 ( )

4. 325,259,202,160,127,105,94

a)94 b)127 c)202 d)259 ( )

5. 1,2,4,8,16,32,64,96

a)4 b)32 c)64 d)96 ( )

6. 10,26,74,218,654,1946,5834

a)26 b)74 c)218 d)654 ( )

7. 1,3,10,21,64,129,356,777

a)21 b)129 c)10 d)356 ( )

8. 3,4,10,32,136,685,4116

a)10 b)32 c)136 d)4116 ( )

III In each of the following questions, various terms of an alphabet series are given with one or more terms missing as shown by (?). Choose the missing terms out of the given alternatives.

1. R, U, X, A, D,?

a)F b)G c)H d)I ( )

2. T, R, P, N, L,?,?

a)J,G b)J,H c)K,H d)K,I ( )

3. a,b,c,f,?,h, g,?,i

a)e,j b)e,k c)f,j d)j,e ( )

4. Z,Y,X,U,T,S,P,O,N,K,?,?

a)G,H b)H,I c)I,H d)J,I ( )

5. A,B,N,C,D,O,E,F,P,?,?,?

a)G,H,I b)G,H,J c)G,H,Q, d)J,K,L ( )

6. A,B,B,D,C,F,D,H,E,?,?

a)E,F b)F,G c)F,I d)J,F e) j,k ( )

7. C,Z,F,X,I,V,L,T,O,?,?

a)O,P b)P,Q c)R,R d)S,R ( )

8. AB,DEF,HIJK,?,STUVWX

a)LMNO b)LMNOP c)MNOPQ d)QRSTU ( )

IV In each of the following questions, a letter-number series is given with one or more terms mission as shown by (?). Choose the missing term out of the given alternatives.

1. D-4, F-6, H-8, J-10, ?, ?

a) K -12, M-13 b)L-12,M-14 c)L-12,N-14 d)K-12,M-14 ( )

2. 3F,6G, 11I, 18L, ? 27

a)21O b)25N c)25P d)27P e) 27Q ( )

3. W-144, ?, S-100, Q-81, O-64

a)U-121 b) U-122 c)V-121 d)V-128 ( )

4. 2Z5,7Y7,14X9,23W11, 34V13, ?

a)27U24 b)45U15 c)47U15 d)47V14 ( )

5. N5V, K7T, ? ,E14P, B19N

a)H9R b)H10Q c)H10R d)I10R ( )

6. find the term which does not fit into the series
1CV,5FU,9IT,15LS,17OR

a)5FU b)15LS c)9IT d)17OR ( )

7.Q1F, S2E,U6D, W21C, ?

a)Y44B b)Y66B c)Y88B d)Z88B ( )

V In each of the following letter series, some of the letters are missing which are given in that order as one of the alternatives below it. Choose the correct alternative.

1. _ _ aba _ _ ba _ab

a)abbba b)abbab c)baabb d)bbaba ( )

2. ab _ _ baa _ _ab _

a)aaaaa b)aabaa c)aabab d)baabb ( )

3. a _ba _ b_b_ a_ b

a)abaab b)abbab c)aabba d)bbabb ( )

4. _ op _ mo _ n _ _ pnmop _

a)mnpmon b)mpnnop c)mnompn d)mnpomn ( )

5. _ nmmn _ mmnn _ mnnm _

a)nmmn b)mnnm c)nnmm d)nmnm ( )

6. ba_ cb _ b_ bab _

a)acbb b)back c)bcaa d)cabb ( )

7. _ aa _ ba _bb _ ab _ aab

a)aaabb b)babab c)bbaab d)bbbaa ( )

8. ab _ d _ aaba _ na _ badna _ b

a)andaa b)babda c)badna d)dbanb ( )

VI Find out the relationship between the first two words and choose the word from the given alternatives.

1. Anaemia : Blood :: Anarchy : ?

a)Lawlessness b) Government c) Monarchy d) Disorder ( )

2. Botany : Plants : : Entomology : ?

a) Snakes b) Insects c)Birds d) Germs ( )

3. Menu : Food : : Catalogue :

a) Rack b) Newspaper c) Library d)Books ( )

4. Pulp : Paper : : Hemp : ?

a) Basket b)Yarn c) Rope d) Cotton ( )

5. Moon : Satellite :: Earth : ?

a) Sun b) Planet c) Solar System d)Asteroid ( )

6. Coconut : Shell :: Letter : ?

a) Letter – Box b) Stamp c) Mail d) Envelope ( )

7. Assam :Bihu :: Kerala : ?

a) Kathakali b) Kuchipudi c)Kathak d)Bharanatyam ( )

8. Man : Machine :: Master : ?

a)Worker b)Manager c) House d)Slave ( )

VII 1. Necklace is related to Jewellery in the same way as Shirt is related to ?

a) Thread b) Cloth c) Cotton d) Apparel ( )

2. Needle is related to Thread in the same way as Pen is related to ?

a) Ink b) Cap c)Paper d) Word e) Stationery ( )

3. Drama is related to Director in the same way as Magazine is related to ?

a) Story b) Editor c) Reader d) Printer ( )

4. Wax is related to Grease in the same way as Milk is related to ?

a) Drink b) Gee c) Curd d) Protein ( )

5. Impossible is related to Feasible in the same way as Theoretical is related to ?

a) Radical b) Usable c) Practical m d) Workable ( )

6. Cyclone is related to Anticyclone in the same way as Flood is related to ?

a) Devastation b) Havoc c) River d) Drought ( )

7. Earth is related to Axis in the same way as Wheel is related to ?

a) Tyre b) Car c)Road d) Hub ( )

8. Income is related to Profit in the same way as Expenditure is related to ?

a)Balance b)Loss c) Sale d)Receipt e) Surplus ( )

VII Find out the relationship between the first two numbers and choose the number from the given alternatives.

1. 18 :3 0 :: 36 : ?

a)54 b)62 c)64 d)66 ( )

2. 6 : 222 :: 7 : ?

a)210 b)336 c)343 d)350 ( )

3. 14 : 9 :: 26 : ?

a)12 b)13 c)15 d)31 ( )

4. 8 : 28 :: 27 : ?

a)55 b)63 c)64 d)65 ( )

5. 68 : 130 :: ? : 350

a) 210 b)216 c)222 d)240 ( )

6. 42 : 56 :: 72 : ?

a)81 b)90 c)92 d)100 ( )

7. 9 : 80 :: 100 : ?

a)901 b)1009 c)9889 d)9999 ( )

8. 149 : 238 :: 159 : ?

a) 169 b) 248 c)261 d)268 ( )

UNIT- 3

BODMASRULE AND SIMPLIFICATION

1. 12573+43495+23472=?
2. (8÷88)×8888088=?
3. The value of 1001÷11of 13 is?'
4. $20\frac{1}{2} + 30\frac{1}{3} - 15\frac{1}{6} = ?$
5. Simplify $2-[2 - \{2 - 2(2 + 2)\}]=?$
6. Simplify $18-[5 - \{6 + 2(7 - \overline{8 - 5})\}]$.
7. $(-5)(4)(2)(-\frac{1}{2})(\frac{3}{4}) = ?$
8. Find the value of $\frac{(6+6+6+6)\div 6}{4+4+4+4\div 4}$
9. What is the value of $\frac{(P+Q)}{(P-Q)}$ if $\frac{P}{Q}=7$?

DECIMAL FRACTIONS

1.If 204 ÷ 12.75 = 16, then 2.04 ÷ 1.275 = ?
2. 0.03 × 0.0124 = ?
3. 7212 + 15.231 - ? = 6879
4. 4211.01 + 22.261 - ? = 2645.759
5.0.004 × 0.5 = ?
6. 24.39 + 562.093 + 35.96 = ?

7. 926 + 9.026 + 0.926 + 9.0026 = ?

8. The expression (12.86 × 12.86 + 12.86 × p + 0.14 × 0.14) will be a perfect square for p equal to

DIVISIBLETY RULE

1. If the the number 5*2 is divisible by 6 then *?
2. If the number 517*324 is completely divisible by 3 , then the smallest whole number in Place of * will be.
3. If the number 481*673 is completely divisible by 9, then the smallest whole number in Place of * will be.
4. If the number 97215*6 is completely divisible by 11, then the smallest whole number in Place of * will be.
5. If the number 91876*2 is completely divisible by 8, then the smallest whole number in Place of * will be.
7. Find the least value of * for which 7*5462 is divisible by 9
8. Find the least value of * for which 4832*18 is divisible by 11.

LCM and HCF:

1. What is the lowest common multiple of 12, 36 and 20?
2. Find the H.C.F of 108,288and 360.
3. Find the greatest common divisor of 24 and 16
4. Two numbers are in the ratio 2 : 3. If their L.C.M. is 48. what is sum of the numbers?
5. The ratio of two numbers is 4 : 5. If the HCF of these numbers is 6, what is their LCM?
6. The H.C.F. of two numbers is 5 and their L.C.M. is 150. If one of the numbers is 25, then the other is:
7. The H.C.F. of two numbers is 11 and their L.C.M. is 693. If one of the numbers is 77, then find the other.
8. Find L.C.M of $\frac{2}{3}\frac{8}{9}\frac{16}{81}$ and $\frac{10}{27}$

BIOOD REALTIONS

1. A is B's sister. C is B's mother. D is C's father. E is D's mother. Then. how is A related to D?
2. P is the brother of Q and R. S is R's mother. T is P's father. Which of the following statements cannot be definitely true?
3. Pointing out to a lady, a girl said, "She is the daughter-in-law of the grandmother of my father's only son." How is the lady related to the girl ?
4. There are six persons A. B. C, D. E and F. C is the sister of F. B is the brother of E's husband. D is the father of A and grandfather of F. There are two fathers. three brothers and a mother in the group. Who is the mother ?
5. Pointing to a person. a man said to a woman. "His mother is the only daughter of your father." How was the woman related to the person ?
6. A girl introduced a boy as the son of the daughter of the father of her uncle. What is the relation between the boy and the girl ?

7. In a family, there are six members A, B, C, D, E and F.A and B are a married couple, A being the male member. D is the only son of C, who is the brother of A. E is the sister of D. B is the daughter-in-law of F, whose husband has died. How is E related to C ?

8. A woman introduces a man as the son of the brother of her mother. How is the man, related to the woman ?

CALENDAR

1. What was the day on 15th august 1947 ?
2. Today is Monday. After 61 days, it will be?
3. The last day of a century cannot be?
4. What was the day of the week on, 16th July, 1776?
5. It was Sunday on Jan 1, 2006. What was the day of the week Jan 1, 2010?
6. What was the day of the week on 28th May, 2006?
7. What will be the day of the week 15th August, 2010?
8. If 6^{th} March, 2005 is Monday, what was the day of the week on 6^{th} March, 2004?

CLOCKS

1. A clock is set right at 8 a.m. The clock gains 10 minutes in 24 hours will be the true time when the clock indicates 1 p.m. on the following day?
2. At what time between 4 and 5 o'clock will the hands of a watch point in opposite directions?
3. An accurate clock shows 8 o'clock in the morning. Through how may degrees will the hour hand rotate when the clock shows 2 o'clock in the afternoon?
4. A clock is set right at 5 a.m. The clock loses 16 minutes in 24 hours.What will be

   the true time when the clock indicates 10 p.m. on 4th day?
5. At what time between 5 and 6 o' clock are the hands of a 3 minutes apart ?
6. Find the angle between the hour hand and the minute hand of a clock when the time is 3.25 ?
7. At what angle the hands of a clock are inclined at 15 minutes past 5?
8. At what time between 2 and 3 o'clock will the hands of a clock be together?

Unit -IV

AVERAGE:

1. The average of 5, 10,15,20,25?
2. Find the average of first 40 natural numbers.
3. The average of four consecutive even numbers is 27. Find the largest of these numbers
4. The average of four consecutive odd numbers is 61 what is the difference between the highest and lowest numbers?
5. The average of 5 numbers is 15 and the average of first three numbers is 10. what is the average of last two numbers?
6. The average age of 15 students of a class is 15 years. Out of these , the average age of 5 student is 14 year and that of the other 9students is 16 years. The age of the 15th student is
7. The average of 5 numbers is 15 and the average of first three numbers is 10 and the average of last three numbers is 20. Then find the middle number?
8. The average of five numbers is 27. If one number is excluded, the average becomes 25.the excluded number is:

RATION & PROPORTION:

1. If A : B = 2 : 3 B : C = 4 :7 then find A : B : C =?
2. If A : B = 2 : 3 B : C = 3 :4 then find A : B : C =?
3. If a:b=2:3 and b:c=3:5 then find a:c=?
4. If 2A=3B and 4B=5C, then A:C is
5. Find the mean proportional of 9 and 25
6. Find the third proportional to 16 and 4
7. If $\frac{A}{3} = \frac{B}{4} = \frac{C}{5}$, then A:B:C is
8. If $\frac{1}{5} : \frac{1}{x} :: \frac{1}{x} : \frac{1}{125}$, then the value of x is

PROBLEM ON AGES:

1. A father said his son . " I was as old as you are at present at the time of your birth. " If the father age is 38 now, the son age 5 years back was :
2. The total age of A and B is 12 years more than the total age of B and C. C is how many years younger than A ?
3. In 10 years. A will be twice as old as B was 10 years ago. If A is now 9 years older than B. the present age of B is :
4. The age of a man is 4 times of his son. Five years ago, the man was nine times old as his son was at that time. The present age of man is?
5. The sum of the present ages of a father and his son is 60 years. five years ago, father's age was four times the age of the son. so now the son's age will be:
6. Six years ago Anita was P times as old as Ben was. If Anita is now 17 years old, how old is Ben now in terms of P ?
7. Sachin is younger than Rahul by 7 years. If the ratio of their ages is 7:9, find the age of Sachin.

8. The ratio of the present ages of P and Q is 3 : 4. Five years ago, the ratio of their ages was 5 : 7. Find their present ages.

TIMES AND DISTANCE-SPEED

1. An athlete runs 200 metres race in 24 seconds. His speed is?
2. How many minutes does Aditya take to cover a distance of 400m, if he runs at a speed of 20 km/hr?
3. A car is running at speed of 108kmph. What distance will it cover in 15 seconds?
4. A cyclist covers a distance of 750 m in 2 min 30 sec. What is the speed in km/hr of the cyclist?
5. Peter can cover a certain distance in 1hr.24min. by covering two third of the distance at 4kmph and the rest at 5kmph. Find the total distance.
6. A and B are two stations 390km apart. A train starts form A at 10 a.m. and travels towards B at 65kmph. Another train starts form B at 11a.m.and travels towards A at 35 kmph. At what time do they meet?

UNIT-V

PERCENTAGES

1. 8 ⅓ % expressed as fraction is ?
2. 2 is what percent of 50?
3. What percent of $\frac{1}{2}$ is $\frac{1}{3}$?
4. X% of Y is Y% of ?
5. What is 25% of 25% equal to?
6. 30% of 140 = ? % of 840
7. 5 % of (50% of Rs 300) is?
8. 270 candidates appeared in an examination, of which 252 passed. The pass percentage is.

PROFIT AND LOSS

1. A man buys a cycle for Rs.1400 and sells it at a loss of 15%. What is the selling price of the cycle?
2. The CP of 21 articles is equal to SP of 18articles. Find the gain (or) loss percent
3. A man buys on article for Rs 27.50 and sells it for Rs 28.60. find his gain percent ?
4. An article is bought for RS. 450 and sold for Rs.400 .what is the loss%?
5. When a commodity is sold for Rs. 34.80 there is a loss of 25%, what is the cost price of commodity?
6. An article is sold at certain price. By selling it at $\frac{2}{3}$ of that price one loses 10%. Find the gain percent at original price..
7. Meena purchased two fans each at Rs.1200. She sold one fan at the loss of 5% and other at the gain 10%.Find the total gain or loss percent?

8. Three partners A, B, C starts a business. Twice the investment of A is equal to thrice the capital of B and the capital of B is four times the capital of C. finds the share of each out of a profit of Rs.297000?

PARTNERSHIP

1. Dhilip and Manohar started a business by investing Rs.100000 and Rs.150000 respectively. Find the share of each out of a profit of Rs.24000?
2. Sanjay and Raju started a business and invested Rs.20000 and Rs.25000 respectively. After 4 months Raju left and Naresh joined by investing Rs.15000.At the end of the year there was a profit of Rs.4600. what is the share of Naresh?
3. Three partners A, B, C starts a business. Twice the investment of A is equal to thrice the capital of B and the capital of B is four times the capital of C. finds the share of each out of a profit of Rs.297000?
4. A, B, C hire meadow for Rs.2934.60. A puts in 10 oxen for 20 days; B 30 oxen for 8 days and C 16 oxen for 9 days. Find the rent paid by each?
5. A and B started a business in partnership by investing Rs.8000 and Rs.7000 respectively. If at the end of a year, a profit of Rs.22, 500 was earned. What is the share of A?
6. In partnership business, A has invested Rs.4200 while B has invested a certain amount. If out of the overall profit of Rs.600, A's share is Rs.320, what is the amount invested by B (in Rs)?
7. Chetan and Suman started a business in partnership by investing Rs.15000 and Rs.18000 respectively. If at the end of the year, Chetan's share in the profit was Rs.1200, what was the amount of total profit?
8. In a partnership business, A has invested 2000 for 5months, while B has invested Rs.3500 for a certain period. If out of the total annual profit of Rs.1440, B's share has been Rs.840. For how many months has he kept his investment in the business?

SIMPLE AND COMPOUND INTEREST

1. Find the simple interest on Rs 7500 in 4 years at 15% .
2. The simple interest on Rs. 6400 at $12\frac{1}{2}$ % per annum is Rs.2000, find the period
3. On what sum of money will the simple interest be Rs.2000 in 5 years 8% per annum?
4. A sum of Rs 1600 gives a simple interest of Rs252 in 2years and 4months. The rate of interest per annum is ?
5. Find the compound interest on Rs 8000 for 3years at 5% per annum
6. A sum of Rs.3000 is lent for 3 years at 10% p.a compound interest. Find the amount
7. Find the amount on Rs 7500 at 4% per annum for 2 years compounded annually.
8. Find the compound interest on Rs.15,625 for 9 months at 16% per annum compounded Quarterly.

P.R.GOVT.COLLEGE (AUTONOMOUS), KAKINADA
III B.Sc. MATHEMATICS - Semester V (w.e.f. 2018-2019)
Course: Ring Theory & Vector Calculus

Total Hrs. of Teaching-Learning: 45 @ 3 hr/Week **Total credits: 3**

Objectives:

- To impart knowledge on Ring Theory and its applications.
- To make awareness of the concepts of the transformation between line Integral, Surface Integral and Volume integral.
- To introduce the concepts of geometrical meaning of Gradient, Divergence and Curl.

Unit – I: Rings – I (11 hrs)

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws in Rings, Integral Domain, Division Ring and Fields, The characteristic of a ring – The characteristic of an Integral Domain, the characteristic of a Field, Sub rings and Ideals.

Unit – II: Rings – II (11 hrs)

Definition of Homomorphism – Homomorphic Image – Elementary Properties of Homomorphism – Kernel of a Homomorphism – Fundamental Theorem of Homomorphism – Maximal Ideals – Prime Ideals.

VECTOR CALCULUS

UNIT:III.Vector differentiation (9 hrs)

Vector differentiation –Ordinary Derivatives of Vector valued functions, Continuity and Differentiation. Gradient , Divergence, Curl operators, Formulae involving these operators.

UNIT:IV.Vector integration: (7 hrs)

Line Integral, Surface Integral, Volume Integrals with examples.

Unit – V: Vector Integration Applications: (7 hrs)

Gauss Divergence Theorem, Stokes theorem, Green's Theorem in plane and applications of these theoremss.

Additional Inputs : Euclidean Ring definition and Examples.

Prescribed text Book:

A text book of Mathematics, Vol. III, S. Chand & Co.

Books for Reference:

1. Topics in Algebra by I.N.Herstine
2. Abstract Algebra by J. Fralieh, Published by Narosa Publishing house
3. Vector Calculus by Santhi Narayan, Published by S.Chand & Company Pvt. Ltd., New Delhi
4. Vector Calculus by R.Gupta, Published by Laxmi Publications.

BLUE PRINT FOR QUESTION PAPER PATTERN

SEMESTER-V, PAPER V

Unit	TOPIC	V.S.A.Q	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	Rings – I	02	03	01	25
II	Rings – II	02	02	O2	28
III	Vector differentiation	01	02	01	19
IV	Vector integration	01	02	01	19
V	Vector Integration Applications	02	01	01	15
TOTAL		08	10	06	106

E.Q = Essay questions (8 marks)
S.A.Q = Short answer questions (5 marks)
V.S.A.Q = Very Short answer questions (1 mark)

Essay questions : 4x8M = 32
Short answer questions : 5x6M =30
Very Short answer questions : 8x1M =08

Total Marks : 70

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations V Semester
Mathematics: Ring Theory & Vector Calculus
Paper–V (Model Paper w. e. f. 2018-2019)

Time: 3 hours | Max. marks : 70M

PART –I

Answer all the following questions. Each question carries 1 mark. 8x1M =8M

1. Define Boolean Ring.
2. Write the zero divisors of $(Z_9, +_9, X_9)$.
3. Find Kernel of the Homomorphism $f: Z(\sqrt{2}) \rightarrow Z(\sqrt{2})$ defined by $f(m + n\sqrt{2}) = m - n\sqrt{2} \ \forall\, m + n\sqrt{2} \in Z(\sqrt{2})$.
4. Give an example to show that every prime ideal need not be a maximal ideal.
5. Find div f, where $f = grad(x^3 + y^3 + z^3 - 3xyz)$
6. Evaluate $\int_0^1 (e^t \bar{i} + e^{-2t} \bar{j})dt$
7. State Green's theorem
8. State the Green's Identities.

PART –II

Answer any THREE questions from each section. Each question carries 5 marks. 6x5M =30M

SECTION – A

9. Show that a ring R has no zero divisors if and only if the cancellation laws hold in R.
10. Prove that the intersection of two ideals of a Ring R is an ideal of R.
11. Prove that a commutative ring R with unity having no proper ideals is a field.
12. Let R and R' be two rings and $f: R \rightarrow R'$ be a homomorphism. Then prove that the Kernel of f is an ideal of R.
13. Let C be the ring of Complex numbers and $M_2(R)$ be the ring of 2 x 2 matrices. If $f: C \rightarrow M_2(R)$ is defined by $f(a + ib) = \begin{bmatrix} a & b \\ -b & a \end{bmatrix}$ then prove that f is an into isomorphism and also find ker f.

SECTION – B

14. Find the directional derivative of $\phi = xy + yz + zx$ at A in the direction of $\overline{AB}$. Where A = (1,2,-1), B= (-1,2,3)
15. Prove that div Curl $\bar{f} = 0$
16. If $\bar{F} = y\bar{i} + z\bar{j} + x\bar{k}$, find the circulation of F round the curve, C where C is

the Circle $x^2 + y^2 = 1, z = 0$.

17. Evaluate $\int_V F dV$ when $F = x\bar{i} + y\bar{j} + z\bar{k}$ and V is the region bounded by x=0,y=0,y=6,z=4 and $z=x^2$.

18. Evaluate $\oint_C (\cos x . \sin y - xy)\, dx + \sin x . \cos y\, dy$, by Green's theorem, where C is the circle $x^2 + y^2 = 1$.

PART –III

Answer any FOUR questions from the following by choosing at least ONE from each section.
Each question carries 8 marks. **4X8M=32M**

SECTION – C

19. Define the characteristic of a ring. Prove that the characteristic of an integral domain is either a prime or zero.
20. State and Prove fundamental theorem of homomorphism in rings.
21. Show that an ideal U of a commutative ring R with unity is maximal if and only if the quotient ring R/U is a field.

SECTION – D

22. Prove that $\nabla \times (\nabla \times A) = \nabla(\nabla . A) - \nabla^2 A$

23. Evaluate $\int_S F.N\, dS$, where $F = zi + xj - 3y^2zk$ and S is the surface $x^2 + y^2 = 16$ included in the first octant between $z = 0$ and $z = 5$.

24. If $F = 4xz\bar{i} - y^2\bar{j} + yz\bar{k}$ find $\int_S F.Nds$ by divergence theorem where S is surface of the cube bounded by x = 0,x=1 , y=0,y=1,z=0,z=1.

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P.R.GOVT.COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc. MATHEMATICS, Semester V (w.e.f 2018-2019)

Course: **Ring Theory & Vector Calculus**

Total Hrs. of Problem Solving Sessions: 30 @ 2 hr / Week in 15 Sessions

Suggested topics for Problem Solving Sessions

1. Rings and Characteristic of a Ring
2. Subrings and Ideals.
3. Homomorphism of a Ring
4. Directional Derivatives and Directional Derivative of Vector Point Function
5. Differential Operators
6. Integration of Vectors
7. Vector Integration Applications

Problem Solving Sessions Examinations Pattern

End of the V semester

(Course: Ring Theory & Vector Calculus)

PRACTICAL EXAMINATION: 50 Marks

Written examination	: 30 M
Record	: 10 M
Cont. Ass.	: 10 M
TOTAL	50 M

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF MATHEMATICS AND STATISTICS

Problems for Problem Solving Sessions

1. RINGS, INTEGRAL DOMAINS and FIELDS

1. Prove that $Q\sqrt{2} = \{a + b\sqrt{2} / a, b \in Q\}$ is a field.
2. Is the ring of even integers an integral domain? Justify your answer.
3. Prove that the set $G = \{a + ib / a, b \in Z, i^2 = -1\}$ of Gaussian integers is an integral domain w.r.t. Addition and multiplication of complex numbers.
4. $E = \{0, 1, 2, 3, 4\}$ Then will $(E, +_5, \times_5)$ form a field? Justify.
5. Give an example of a division ring which is not a field and justify.

2. CHARECTERSTIC OF A RING AND SUBRINGS

1. Prove that the characteristic of a Boolean ring R is 2 .
2. If R is a ring of characteristic 2 and $a, b \in R \Rightarrow ab = ba$ then show that $(a+b)^2 = a^2 + b^2 = (a-b)^2$
3. Show that the set of matrices $\begin{bmatrix} a & b \\ 0 & c \end{bmatrix}$ is a sub ring of the *2X2* matrices whose elements are integers.
4. Let R be a ring and $a \in R$ be a fixed element. Then prove that $\{x \in R / ax = 0\}$ is a subring.
5. If R is a ring $C(R) = \{x \in R / ax = xa \forall a \in R\}$ then Prove that $C(R)$ is a sub ring of R.

3. HOMOMORPHISM OF RINGS

1. If $Z(\sqrt{2}) = \{m + n\sqrt{2} / m, n \in Z\}$ be a ring under addition and multiplication then prove that $f : Z(\sqrt{2}) \to Z(\sqrt{2})$ defined by $f(m + n\sqrt{2}) = m - n\sqrt{2}, \forall m + n\sqrt{2} \in Z(\sqrt{2})$ is an isomorphism.
2. Let $R = \{m + in / m.n \in Z\}$ be the ring of Gaussian integers and Z the ring of integers. Is the mapping $f : R \to Z$ defined by $f(m+in) = m, \ \forall m+in \in R$, a homomorphism?
3. Let R be the ring of integers and R^I be the set of even integers in which addition is same as that of integers and multiplication (*) is defined by $a * b = ab / 2 \forall a, b \in R$. Prove that R is isomorphic to R^I
4. If $f : R \to R$ is defined by $f(x) = 2x$,is f a homomorphism of rings? Give reason.
5. Let $R^1 = \left(\begin{bmatrix} a & 0 \\ 0 & 0 \end{bmatrix} / a \in R \right)$ where R is the ring of real numbers. Prove that $f : R^1 \to R$ defined by $f\left(\begin{bmatrix} a & 0 \\ 0 & 0 \end{bmatrix} \right) = a, \forall \begin{bmatrix} a & 0 \\ 0 & 0 \end{bmatrix} \in R^1$ is an isomorphism.

4. DERIVATIVES OF A VECTOR FUNCTION AND DIRECTIONAL DERIVATIVE

1. If $\bar{a}=\sin t\bar{i}+\cos t\bar{j}+t\bar{k}$, $\bar{b}=\cos t\bar{i}-\sin t\bar{j}-t\bar{k}$, $\bar{c}=2\bar{i}+3\bar{j}-3\bar{k}$ then find $\frac{d}{dt}\left[\bar{a}\times(\bar{b}\times\bar{c})\right]$ at t=0
2. If $\phi=xy^2z$ and $\bar{A}=xz\bar{i}-xy^2\bar{j}+yz^2\bar{k}$ find $\frac{\partial^3(\phi\bar{A})}{\partial x^2\partial z}$ at (2,-1,1)
3. A particle moves along a curve whose parametric equations are $x=e^{-t}$, $y=2\cos 3t$, $z=2\sin 3t$, where t is the time, determine its velocity and acceleration at any time.
4. Find the directional derivative of $f=x^2yz+4xz^2$ at the point (1,-2,-1) in the direction of $2\bar{i}-\bar{j}-2\bar{k}$
5. Find the angle between the surfaces $x^2+y^2+z^2=9$, $z=x^2+y^2-3$ at the point (2,-1,2)

5. DIFFERENTIAL OPERATORS

1. If $a=x+y+z, b=x^2+y^2+z^2, c=xy+yz+zx$. Prove that $\left[grad\ a, grad\ b, grad\ c\right]=0$.
2. If $\bar{a}$ is a constant vector, prove that curl $\frac{\bar{a}\times\bar{r}}{r^3}=\frac{-\bar{a}}{r^3}+\frac{3\bar{r}}{r^5}(\bar{a}.\bar{r})$
3. Prove that $(\bar{f}\times\nabla)\times\bar{r}=-2\bar{f}$.
4. Prove that curl $(\bar{A}\times\bar{B})=\bar{A}\,div\bar{B}-\bar{B}\,div\bar{A}+\bar{B}\,div\,\bar{A}+(\bar{B}.\nabla)\bar{A}-(\bar{A}.\nabla)\bar{B}$.
5. Prove that $div\{(\bar{r}\times\bar{a})\times\bar{b}\}=-2(\bar{a}.\bar{b})$ Where $\bar{a}$ and $\bar{b}$ are constant vector.

6. INTEGRATION OF VECTORS

1. If $\bar{F}=(x^2+y^2)\bar{i}-2xy\bar{j}$ evaluate $\oint\bar{F}\cdot d\bar{r}$ where the curve C is the rectangle in the XY plane bounded by $y=0, y=b, x=0, x=a$
2. Evaluate $\int_s F.N\,dS$, where $\bar{F}=z\bar{i}+x\bar{j}-3y^2z\bar{k}$ and S is the surface $x^2+y^2=16$ included in the first octant between $z=0$ and $z=5$
3. If $\bar{F}=4xz\bar{i}-y^2\bar{j}+yz\bar{k}$ evaluate $\int\bar{F}.N\,dS$ where S is the surface of the cube bounded by $x=0, x=a, y=0, y=a, z=0, z=a$.
4. If $\bar{F}=(2x^2-3z)\bar{i}-2xy\bar{j}-4x\bar{k}$ evaluate
   (a) $\int_V\nabla\cdot\bar{F}\,dV$ (b) $\int_V\nabla\times\bar{F}dV$ where V is the closed region bounded by $x=0, y=0, z=0, 2x+2y+z=4$
5. Find $\int_s F.N\,dS$ over the entire surface of the region bounded by $x^2+z^2=9; x=0, y=0, z=0$ and $y=8$ if $\bar{F}=6z\bar{i}+(2x+y)\bar{j}-x\bar{k}$

7.VECTOR INTEGRATION APPLICATIONS

1. Verify Gauss's divergence theorem to evaluate $\int_s ((x^3 - yz)\bar{i} - 2x^2 y\bar{j} + z\bar{k}).\bar{N}ds$ over the surface of a cube bounded by the coordinate planes $x = y = z = a$
2. Evaluate by Gauss divergence theorem $\iint_s 4xz\,dy\,dz - y^2\,dz\,dx + yz\,dx\,dy$ where S is the surface of the cube bounded by the planes $x=0, x=1, y=0, y=1, z=0, z=1$.
3. Verify Green's theorem in the plane for $\oint_c (3x^2-8y^2)dx+(4y-6xy)dy$ where **C** is the region bounded by $y=\sqrt{x}$ and $y=x^2$.
4. Find $\int_c (3x^2-8y^2)dx + (4y-6xy)dy$ by Green's theorem where **C** is the boundary defined by $x=0, y=0, x+y=1$.
5. Verify Stokes theorem for $A=(2x-y)\bar{i}-yz^2\bar{j}-y^2z\bar{k}$, where **S** is the upper half surface of the sphere $x^2+y^2+z^2=1$ and **C** is its boundary.
6. If $F=(y^2+z^2-x^2)\bar{i}+(z^2+x^2-y^2)\bar{j}+(x^2+y^2-z^2)\bar{k}$, evaluate $\int$ Curl F.N dS taken over the portion of the surface $x^2+y^2-2ax+az=0$ above the plane $z=0$.

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc., MATHEMATICS – Semester V (w.e.f 2018-19)

Paper VI Course: Linear algebra

Total Hrs. of Teaching-Learning: 45 @ 3h / Week **Total Credits: 03**

Objective:

- To improve the students ability of understanding the most application oriented topic in Mathematics that is Linear Algebra.
- To equip the skill of understanding the concepts and writing the proofs of the Theorems.

Unit I : Vector spaces – I **(9 hrs)**

Vector spaces, General properties of vector spaces, n-dimensional vectors, addition and scalar multiplication of vectors, internal and external composition, Null Space, Vector Subspaces, Algebra of subspaces, Linear sum of two subspaces, Linear combination of vectors, linear span, linear dependence and linear independence of Vectors.

Unit II : Vector spaces – II **(9 hrs)**

Basis of vector space, Finite dimensional vector space, basis extension, co ordinates, dimension of vector space, dimension of subspace, quotient space and Dimension of Quotient space.

Unit III: Linear transformations: **(7 hrs)**

Linear transformations, linear operators, properties of linear transformation, sum and product of linear transformations, Algebra of Linear Operators, Range space and NullSpace of LT, Rank and Nullity of a LT, Rank & Nullity theorem.

Unit IV : Matrix: **(9 hrs)**

Linear Equations, Characteristic Values and Characteristic Vectors of square matrix - Cayley-Hamilton Theorem.

Unit V: Inner Product space: **(11 hrs)**

Inner Product spaces, Euclidean and Unitary spaces, Norm or length of a vector, Schwartz's inequality, Triangle Inequality, Parallelogram law, orthogonality and orthonormal set, complete orthonormal set, Gram-Schmidt Orthogonalisation Process, Bessel's inequlity and Parsvels identity.

Prescribed Text Books:

J.N. Sharma & A.R.Vasista, Linear Agebra, Krishna Prakasham Mandir , Meerut.

Books for Reference:

1. III year Mathematics Linear Algebra and Vector Calculus, Telugu Academy.
2. A Text Book of B.Sc. Mathematics Vol III, S.Chand&Co.

BLUE PRINT FOR QUESTION PAPER PATTERN
SEMESTER-V, PAPER VI

Unit	TOPIC	V.S.A.Q	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Vector spaces - I	02	01	01	15
II	Vector spaces - II	01	02	01	19
III	Linear Transformation	01	02	01	19
IV	Char. values and char. vectors	02	02	01	20
V	Inner product spaces	02	03	02	33
Total		08	10	06	106

V.S.A.Q. = Very Short answer questions (1mark)
S.A.Q. = Short answer questions (5 marks)
E.Q . = Essay questions (8 marks)

Very Short answer questions : 8 x 1M = 08
Short answer questions : 6 x 5M = 30
Essay questions : 4 x 8M = 32

Total Marks 70

P.R Govt.College (Autonomous), Kakinada
III year B.Sc. Degree Examinations, – V Semester
Mathematics Course : Linear Algebra
Paper-VI (Model Paper w.e.f.2018-19)

Time: 3 hours **Max.Marks: 70M**

PART –I

Answer the following questions. Each question carries 1 mark. **8x1M =8M**

1. Define linear combination of vectors
2. If S, T are the subspaces of vector space V(F) then L(SUT)=
3. The standard basis of $V_2(R)$ is.....
4. Find the null space of the transformation $T: R^2 \rightarrow R^3$ defined by $T(x, y) = (x+y, x-y, y)$
5. Define Eigen vector of a square matrix.
6. Find the Eigen values of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$
7. Find the length of the vector $\alpha = (2,1,1+i)$
8. Write Bessel's inequality.

PART –II

Answer any Six questions by choosing Three from each section. **6 x 5M =30M**

SECTION – A

9. Determine whether the following set of vector is L.D or L.I {(1,-2,1),(2,1,-1)(7,-4,1)}.

10. Show that the set of vectors { (2,1,4),(1,-1,2),(3,1,-2)} form a basis for R^3.

11. If W is a subspace of a finite dimensional vector space $V(F)$ then prove that W is also finite dimensional and $\dim W \leq \dim V$

12. Find T(x, y, z) where T: $R^3 \rightarrow R$ is defined by T(1,1,1)=3, T(0,1,-2)=1, T(0,0,1)= -2.

13. State and prove rank and nullity theorem.

SECTION – B

14. Solve the system of linear equations

$$2x - 3y + z = 0, x + 2y - 3z = 0, 4x - y - 2z = 0.$$

15. State and prove Cayley - Hamilton theorem.

16. State and Prove Triangle inequality.

17. Prove that $\{(3/5, 0, 4/5), (-4/5, 0, 3/5), (0, 1, 0)\}$ form an orthogonal subset of $R^3(R)$ space.

18. State and prove Parsevel's identity.

PART –III

Answer any Four questions by choosing at least ONE from each section. **4 X 8=32M**

SECTION – C

19. Let V(F) be a vector space and $S = \{\alpha_1, \alpha_2, ...\alpha_n\}$ is a finite subset of non-zero vectors of V(F). Then S is linearly dependent if and only if some vector $\alpha_k \in S$, $2 \le k \le n$, can be expressed as a linear combination of its preceding vectors.
20. Let W be a sub space of a finite dimensional vector space V(F), then prove that dimV/W=dimV-dimW.
21. Find the null space, range, rank and nullity of the transformation T: $R^2 \to R^3$ defined by $T(x, y) = (x + y, x - y, y)$.

SECTION – D

22. Find the characteristic roots and the corresponding vectors of the matrix

$$A = \begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$$

23. State and Prove Cauchy-Schwarz's inequality.

24. Applying Gram Schmidt process obtain an orthonormal basis of $R^3(R)$ from the basis

$\{(2,0,1), (3,-1,5), (0,4,2)\}$.

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P.R.GOVT.COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc. MATHEMATICS, Semester V (w.e.f 2018-2019)

Course Code: Linear Algebra

Total Hrs. of Problem Solving Sessions: 30 hrs @ 2 hr/Week in 15 Sessions

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Suggested topics for Problem Solving Sessions

1. Vector Spaces
2. Basis and Dimensions-I
3. Basis and Dimensions-II
4. Linear Transformation
5. Linear Equations
6. Characteristic Values and Cayley Hamilton Theorem
7. Inner Product Spaces
8. Orthogonality

PROBLEM SOLVING SESSIONS EXAMINATION PATTERN

End of the V semester

(Course: Linear Algebra)

PRACTICAL EXAMINATION: 50 Marks

Written examination	: 30M
Record	: 10 M
Cont.Ass.	: 10 M
TOTAL	50 M

P. R. GOVT. COLLEGE(A), KAKINADA

DEPARTMENT OF MATHEMATICS and STATISTICS

PROBLEMS FOR PROBLEM SOLVING SESSIONS IN LINEAR ALGEBRA

1. Vector Space and Linear Dependence and Independence of Vectors

1. Prove that the set of all real valued continuous functions defined in the (0,1) is a vector space over the field of real numbers, with respect to the operations of addition and scalar multiplication defined as $i)(f+g)(x) = f(x)+g(x)$ $ii)(af)(x) = af(x)$, where a is real and $0 < x < 1$.
2. Let V be the set of all pairs (a, b) of real numbers and R be the field of real numbers.Show that with the operations $(a_1, b_1) + (a_2, b_2) = (a_1 + a_2, 0), c(a_1, b_1) = (ca_1, b_1)$, V is not a vector space.
3. Show that the vector $\alpha = (2,-5,3)$ in R^3 cannot be expressed as a linear combination of the vectors $e_1 = (1,-3,2), e_2 = (2,-4,-1), e_3 = (1,-5,7)$.
4. In the vector space $R^3(R)$. Let $\alpha = (1,2,1)$, $\beta = (3,1,5)$, $\gamma = (3,-4,5)$.Show that subspace spanned by $S = \{\alpha,\beta\}$ and $T = \{\alpha,\beta,\gamma\}$ are the same.
5. Prove that the four vectors $\alpha = (1,0,0), \beta = (0,1,0), \gamma = (0,0,1), \delta = (1,1,1)$ in $V_3(C)$ form L.D. set, but any three of them are L.I.
6. If α,β,γ are linearly independent vectors of V(R) show that $\alpha + \beta$, $\beta + \gamma$, $\gamma + \alpha$ are also L.I.

2.Basis and Dimensions-I

1. Show that the set $\{(1,0,0),(1,1,0),(1,1,1)\}$ is a basis of $C^3(C)$.Hence find the coordinates of the vector $(3+4i,6i,3+7i)$ in $C^3(C)$.
2. The set $S_4 = \{\alpha,\beta,\gamma,\delta\}$ where $\alpha = (1,0,0)$, $\beta = (1,1,0)$, $\gamma = (1,1,1)$, $\delta = (0,1,0)$ is a spanning set of $R^3(R)$ but not a basis of set.
3. If $\alpha = (1,-1,0), \beta = (2,1,3)$ find a basis for R^3 containing α and β.
4. If $\alpha_1 = (1,2,-1)$, $\alpha_2 = (-3,-6,3)$, $\alpha_3 = (2,1,3)$, $\alpha_4 = (8,7,7)$ and if $S = \{\alpha_1,\alpha_2,\alpha_3,\alpha_4\}$ is such that L(S) = W, find a basis by reducing S.

3.Basis and Dimensions-1I

1) Let W_1 and W_2 be two subspaces of R^4 given by $W_1=\{(a,b,c,d);\ b-2c+d=0\}$, $W_2=\{(a,b,c,d);\ a=d, b=2c\}$.Find the basis and dimension of (i)W_1 (ii)W_2 (iii) $W_1 \cap W_2$ and hence find $\dim[W_1 + W_2]$.
2) If W is the subspace of $V^4(R)$, generated by the vectors (1,-2,5,-3), (2,3,1,-4), and (3,8,-3,-5) find a basis of W and its dimension.
3) V is the space generated by the polynomials $\alpha = x^3+2x^2-2x+1$, $\beta = x^3+3x^2-x+4$, $\gamma = 2x^3+x^2-7x-7$ .Find the basis of V and its dimension?
4) Let W_1 and W_2 be the subspaces of R^4 generated by {(1,1,0,-1),(1,2,3,0),(2,3,3,-1)} and {(1,2,2,-2),(2,3,2,-3),(1,3,4,-3)} respectively.Find (i)dim W_1 (ii)dim W_2 (iii)$\dim[W_1+W_2]$ (iv)$\dim[W_1 \cap W_2]$.

4.Linear Transformation

1) P and Q are the two subspaces of R^4 defined by $P = \{(a,b,c,d);\ b+c+d = 0\}, Q = \{(a,b,c,d); a+b = 0, c = 2d\}$. Find the dimension and basis of P, Q and $P \cap Q$.
2) Describe explicitly the linear transformation $T: R^2 \to R^2$ such that $T(2,3) = (4,5)$ and $T(1,0) = (0,0)$.
3) Find $T(x,y,z)$ where $T: R^3 \to R$ defined by $T(1,1,1) = 3, T(0,1,-2) = 1, T(0,0,1) = -2$.

4) Find a linear transformation $T: R^3 \rightarrow R^3$ whose range is spanned by $(1,2,0,-4),(2,0,-1,-3)$.
5) Find the null space,range,rank and nullity of the transformation $T: R^3 \rightarrow R^3$ defined by $T(x,y) = (x+y, x-y, y)$.

5.Linear Equations

1. Solve the system of linear equations $2x-3y+z=0, x+2y-3z=0, 4x-y-2z=0$.
2. Solve $2x-y+z=0, 3x+2y+z=0, x-3y+5z=0$.
3. Show that the system of equations $x+y+z=6, x+2y+3z=14, x+4y+7z=30$.
4. Discuss for all values of λ, the system of equations $x+y+4z=6, x+2y-2z=6,$ $\lambda x+y+z=6$, as regards existence and nature of solutions.

6.Eigen Values, Eigen Vectors and Cayley-Hamilton Theorem

1. Find the characteristic roots and the corresponding characteristic vectors of the matrix
$$\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$$
2. Find the characteristic roots and the corresponding characteristic vectors of the matrix
$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$
3. Show that $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ satisfies its characteristic equation and hence find A^{-1}
4. State Cayley-Hamilton theorem and verify for the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and hence find A^{-1}

7.INNER PRODUCT SPACE

1. Let α = <2,1+i,i>, β = <2-i,2,1+2i> be two vectors in V_3 (C) ,compute $<\alpha, \beta>$, $\|\alpha\|$, $\|\beta\|$ and $\|\alpha+\beta\|$. Also verify Cauchy-Schwartz inequality and triangle inequality.
2. If α =(4,3,1,-2), β =(-2,1,2,3) be two vectors in the vector space V_4(R) with standard inner product then find the angle between α and β.
3. If α, β are two vectors in an inner product space, then α, β are linearly dependent if and only if $|<\alpha, \beta>| = \|\alpha\| \|\beta\|$.
4. Two vectors α, β in an unitary space $V(C)$ are such that $<\alpha, \beta>=0$ iff $\| a\alpha + b\beta \|^2 = |a|^2 \|\alpha\|^2 + |b|^2 \|\beta\|^2 \ \forall$ a,b $\in$ C.
5. If u,v are two vectors in a complex inner product space with standard inner product then prove that $4<u,v> = \|u+v\|^2 - \|u-v\|^2 + i\|u+iv\|^2 - i\|u-iv\|^2$.

8.ORTHOGONALITY

1. Prove that S= $\{(1/3, -2/3, -2/3), (2/3, -1/3, 2/3), (2/3, 2/3, -1/3)\}$ is an orthonormal set in $\mathbf{R}^3$ with standard inner product space.
2. In $R_4(R)$, if (1,0,1,1), (-1,0,-1,1), (0,-1,1,1) are three linearly independent vectors, compute the orthonormal set of these vectors.
3. Apply Gram-Schmidt process to the vectors $\beta_1=(1, 0, 1), \beta_2=(1, 0, -1)$ and $\beta_3=(0, 3, 4)$ to obtain an orthonormal basis for $R^3(R)$ with standard inner product.
4. Given $\{(2,1,3), (1,2,3), (1,1,1)\}$ is a basis of R^3, construct an orthonormal basis.
5. If W is a subspace of finite dimensional inner product space V(F) then prove that $W=\left(W^{\perp}\right)^{\perp}$

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc. MATHEMATICS – Semester VI (w.e.f. 2018-19)

Course (Elective VII (A)) : LAPLACE TRANSFORMS

Total Hours of Teaching-Learning : 45 @ 3h/week Total credits:02

Objectives:

- To understand the concepts of Laplace Transform and Inverse Laplace Transform.
- To find the Laplace transform of some functions.

UNIT – I Laplace Transform I : **(9 hrs)**

Definition of - Integral Transform – Laplace Transform Linearity, Piecewise continuous Functions, Existence of Laplace Transform, Functions of Exponential order, and of Class A.

UNIT – II Laplace Transform II: **(7hrs)**

First Shifting Theorem. Second Shifting Theorem, Change of Scale Property, Laplace Transform of the derivative of f(t), Initial Value theorem and Final Value Theorem.

UNIT – III Laplace Transform III : **(8 hrs)**

Laplace Transform of Integrals – Multiplication by t, Multiplication by t^n – Division by t. Laplace Transform of Bessel's function, Laplace Transform of error function, Laplace Transform of Sine and cosine integrals.

UNIT –IV Inverse Laplace Transform I : **(10 hrs)**

Definition of Inverse Laplace Transform. Linearity, First Shifting Theorem, Second Shifting Theorem, Change of Scale property, use of partial fractions, Examples.

UNIT – V Inverse Laplace Transform II : **(11 hrs)**

Inverse Laplace transforms of Derivatives–Inverse Laplace Transforms of Integrals – Multiplication by spowers of p – Division powers of 'p'—Convolution definition- Convolution Theorem – proof and Applications – Heaviside's Expansion theorem and its Applications.

Prescribed Text book:

Integral Transforms by A.R.Vasishta and R.K. Gupta, Krishnaprakasan media Pvt. Ltd. Meerat.

Reference Books:

Integral Transforms by Dr.J.K.Goyal and K.P.Gupta, PragatiPrakashan.

M.D.Raisinghania Integral Transform, S.Chand& Co., New Delhi.

BLUE PRINT FOR QUESTION PAPER PATTERN
SEMESTER-VI,
PAPER –VII, Elective VII (A)

UNIT	TOPIC	V.S.A.Q	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Laplace Transforms - I	02	01	01	15
II	Laplace Transforms - II	01	02	01	19
III	Laplace Transforms - III	01	02	01	19
IV	Inverse Laplace Transforms - 1	02	03	02	33
V	Inverse Laplace Transforms - 2	02	02	01	20
Total		08	10	06	106

V.S.A.Q. = Very Short answer questions (1mark)
S.A.Q.= Short answer questions (5 marks)
E.Q .= Essay questions (8 marks)

Very Short answer questions : 8x1M =08
Short answer questions : 6x5M =30
Essay questions : 4x8M = 32

Total Marks: 70

P.R.Government College (Autonomous), Kakinada

III Year B.Sc. Degree Examinations VI Semester Mathematics

Course (Elective VII (A)) LAPLACE TRANSFORMS

PAPER VII MODEL PAPER (w.e.f. 2018-19)

Time: 3 hours **Max marks: 70M**

PART - I

Answer all the Questions. Each question carries 1 mark. **8x1=8M**

1. Define Laplace Transform.
2. Prove that $F(t) = t^n$ is of exponential order as $t \to \infty$.
3. Find $L[t^3 e^{-3t}]$.
4. What is the Laplace transform of $L\{\frac{sint}{t}\}$
5. Define Inverse Laplace Transform.
6. Write the Inverse of Laplace Transform of $\frac{a}{p^2+a^2}$.
7. If $L^{-1}\{f(p)\} = F(t)$ then what is the inverse Laplace transform of $f^{(n)}(p)$?
8. Write the Heavi-side's expansion formula.

PART - II

Answer any Three questions from each section. Each question carries 5 marks. 6x5 =30M

SECTION – A

9. Find $L\{t^n\}, n$ is a positive integer.
10. State and Prove first shifting theorem in Laplace Transforms.
11. If $L\{F(t)\} = f(p) then\ prove\ that\ L\{F(at)\} = \frac{1}{a} f\left(\frac{p}{a}\right)$.
12. Find $L\{t(3sin2t - 2cos2t)\}$
13. Find $L\{(1 + te^{-t})^3\}$.

SECTION – B

14. Find $L^{-1}\left\{\frac{3p-2}{p^2-4p+20}\right\}$.
15. Find$L^{-1}\left[\frac{e^{4-3p}}{(p+4)^{5/2}}\right]$.
16. Prove that$L^{-1}\left\{\frac{2p+1}{(p+2)^2(p-1)^2}\right\}=\frac{1}{3}t(e^t - e^{-2t})$

17. Find $L^{-1}\left\{\frac{p}{(p^2+a^2)^2}\right\}$

18. Find $L^{-1}\left\{\log\left(1+\frac{1}{p^2}\right)\right\}$.

PART - III

Answer any four questions by choosing at least one from each section. **4x8=32**

SECTION – C

19. Find $L\{F(t)\}$, where $F(t) = \begin{cases} 0 & \text{when } 0 < t < 1 \\ 1 & \text{when } 1 < t < 2 \\ 0 & \text{when } \quad t > 2 \end{cases}$

20. Find $L\{sin\sqrt{t}\}$.

21. Find $L\{C_i(t)\}$

SECTION – D

22. Prove that $L^{-1}\left\{\frac{4p+5}{(p-1)^2(p+2)}\right\} = 3te^t + \frac{1}{3}e^t - \frac{1}{3}e^{-2t}$

23. Show that $L^{-1}\left\{\frac{p^2}{(p^4+4a^4)}\right\} = \frac{1}{2a}(coshat.sinat + sinhat.cosat)$.

24. Apply convolution theorem to find the inverse Laplace transform of the function $\frac{1}{(p-2)(p^2+1)}$.

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P.R.GOVERNMENT COLLEGE (AUTOMONOUS), KAKINADA

III B.SC MATHEMATICS – Semester VI (w.e.f. 2018-19)

Course (Elective-VII (B)): Numerical Analysis

Total Hrs. of Teaching-Learning: 45 @ 3 h / Week — Total Credits: 03

Objective:

- To find the different types of errors in computation and then to reduce the errors
- To find the approximate Polynomial for the given data when the data is even or uneven by using interpolation, also we can find the differentiation even if the function is not known explicitly.
- To find the solution of Algebraic and Transcendental equations using Bisection, Falsi Position, Iteration and Newton Raphson methods.

Unit I: Errors in Numerical Computation (6 hrs)

Errors and their accuracy, Mathematical preliminaries, Errors and their analysis, Absolute, Relative and Percentage errors, A general error formula, Errors in a series approximation.

Unit II: Solutions of Algebraic and transcendental equations (10 hrs)

(a) Bisection Method (b) Iteration Method (c) Method of false position (d) Newton Raphson Method (e) Generalised Newton Raphson method (f) Muller's method

Unit III: Interpolation – I (8 hrs)

Errors in polynomial interpolation, Finite Differences, Forward, Backward and central difference operators, Shift and average difference operators, symbolic relation between the operators, Detection of errors by use of difference tables, differences of a polynomial.

Unit IV: Interpolation - II (12 hrs)

Interpolation for equal intervals: Newton's forward, backward, Gauss forward, Backward, Strilling's, Bessel's and Everette's formulae.

Unit V: Interpolation – III (9 hrs)

Interpolation for uneven intervals: Lagrange's interpolation formula, error in Lagrange's Interpolation, divided differences and their properties, relation between divided differences formula, Forward, Backward and central difference operators, Newton's divided differences, Inverse Interpolation..

Prescribed Text books:

Numerical Analysis by S. Ranganatham, MVSSN Prasad, Dr. V. Ràmesh Babu. S. Chand & Company

Reference books:

Numerical Analysis by S.S.Sastry Prentice Hall, NewDelhi

Numerical Analysis by Kamali Surya Narayana, Schand&co, NewDelhi

Numerical Analysis by Gupta &Malik, Krishna Prakashan media (P) Ltd Meerut"

BLUE PRINT FOR QUESTION PAPER PATTERN,
SEMESTER-VI
PAPER –VII, ELECTIVE VII (B)

UNIT	TOPIC	V.S.A.Q	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Errors in Numerical Computations	01	02	01	19
II	Solutions of Algebraic and transcendental equations	02	03	02	33
III	Interpolation - I	02	02	01	20
IV	Interpolation - II	02	02	01	20
V	Interpolation - III	01	01	01	1[illegible]
Total		08	10	06	106

V.S.A.Q. = Very Short answer questions (1mark)
S.A.Q.= Short answer questions (5 marks)
E.Q .= Essay questions (8 marks)

Very Short answer questions : 8x1M =08
Short answer questions : 6x5M =30
Essay questions : 4x8M = 32

Total Marks : 70

P.R.Govt.College (Autonomous), Kakinada

III year B.Sc. Degree Examinations VI Semester Mathematics

Course (Elective VII (B)) : Numerical Analysis

Paper VII: MODEL PAPER (w.e.f.2018-19)

Time: 3hours | Max marks=70M

PART-I

Answer all the questions. Each question carries 1 mark 8X1=8M

1. Estimate 1/3 to three significant digits and find its absolute error .
2. Define algebraic equation.
3. Write the convergent condition for iterative method.
4. Prove that Δ=E-1.
5. Define Shift operator.
6. Write the Gauss forward interpolation formula.
7. Write the Bessel's Formula for interpolation
8. Write the divided difference of $f(x) = x^2 - 5$ for the arguments 2 and 4.

PART-II

Answer any three questions from each section. Each question carries 5 marks. 6X5=30M

SECTION A

9. Evaluate the sum S = $\sqrt{3}+\sqrt{5}+\sqrt{7}$ to four significant digits and find its absolute and relative errors.
10. Define absolute, relative and percentage errors and give an example.
11. Explain Bisection Method.
12. Solve the equation Sin x=5x-2 by iteration method.
13. Find a root of the equation x^3-2x-5=0 by using Newton- Raphson method.

SECTION B

14. Prove that 1) E= e^{hD} 2) $\mu^2 = 1 + \frac{1}{4}\delta^2$
15. Find the missing term in the following data given below

x	0	1	2	3	4
y	1	3	9	-	81

16. Derive Newton's forward interpolation formula
17. Find the third divided difference for the function f(x) = $x^3 + x + 2$ for the arguments 1,3,6,11 Apply Stirling's formula to find the value of f(1.22) from

x	0	0.5	1.0	1.5	2.0
f(x)	0	0.191	0.341	0.433	0.477

18. Using the inverse Lagrange's Interpolation Formula if $y_1 = 4, \ y_3 = 12, \ y_4 = 19, y_x = 7$ then find the value of x

PART – III

Answer any four questions by choosing at least one question from each section. **4X8=32M**

SECTION C

19. If $u=4x^2y^3/z^4$ and errors in x, y, z be 0.001, compute the relative maximum error in u, when x=y=z=1.

20. Find the real root of the equation $x^3-9x+1=0$ by using Regula Falsi Method.

21. Find the root of the equation $f(x) = e^x-3x$ by using Newton-Raphson method.

SECTION D

22. Prove that $\left(\frac{\Delta^2}{E}\right)e^x.\left(\frac{Ee^x}{\Delta^2 e^x}\right) = e^x$, the interval of differencing being unit

23. Using Newton's Forward interpolation formula, find the value of f(x) when x=1.4

X	1.1	1.3	1.5	1.7	1.9
Y	0.21	0.69	1.25	1.89	2.61

24. By means of Newton's divided difference formula, find the value f(8) and f(15) from the following table :

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

***

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc. MATHEMATICS - Semester VI (w.e.f. 2018-19)

Course (Elective VII (C)) : NUMBER THEORY

Total Hours of Teaching-Learning : 45 @ 3h/week Total credits:03

Objectives:

- To understand the concepts of Number Theory.
- To know about the applications of Number Theory

UNIT-I Divisibility (6 hrs)

Divisibility – Greatest Common Divisor – Euclidean Algorithm – The Fundamental Theorem of Arithmetic

UNIT-II Congruences (10 hrs)

Congruences – Special Divisibility Tests - Chinese Remainder Theorem- Fermat's Little Theorem – Wilson's Theorem – Residue Classes and Reduced Residue Classes – Solutions of Congruences

UNIT-III Number Theory from an Algebraic Viewpoint (7 hrs)

Number Theory from an Algebraic Viewpoint – Multiplicative Groups, Rings and Fields

UNIT-IV Quadratic Residues (12 hrs)

Quadratic Residues - Quadratic Reciprocity – The Jacobi Symbol

UNIT-V Greatest Integer Function (10 hrs)

Greatest Integer Function – Arithmetic Functions – The Moebius Inversion Formula

Reference Books:

1. "Introduction to the Theory of Numbers" by Niven, Zuckerman & Montgomery (John Wiley & Sons)
2. "Elementary Number Theory" by David M. Burton.
3. Elementary Number Theory, by David, M. Burton published by 2nd Edition (UBS Publishers).
4. Introduction to Theory of Numbers, by Davenport H., Higher Arithmetic published by 5th Edition (John Wiley & Sons) Niven,Zuckerman & Montgomery.(Camb, Univ, Press)

5. Number Theory by Hardy & Wright published by Oxford Univ, Press.

6. Elements of the Theory of Numbers by Dence, J. B & Dence T.P published by Academic Press.

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UNIT	TOPIC	V.S.A.Q	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Divisibility	02	01	01	15
II	Congruence	01	02	01	19
III	Number Theory from an Algebraic view point	01	02	01	19
IV	Quadratic Residues	02	03	02	33
V	Greatest Integer Function	02	02	01	20
Total		08	10	06	106

V.S.A.Q. = Very Short answer questions (1mark)
S.A.Q.= Short answer questions (5 marks)
E.Q .= Essay questions (8 marks)

Very Short answer questions : 8x1M =08
Short answer questions : 6x5M =30
Essay questions : 4x8M = 32

Total Marks: 70

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III Year B.Sc. Degree Examinations VI Semester MATHEMATICS

Course (Elective VII (C) NUMBER THEORY

PAPER VII, MODEL PAPER (w.e.f. 2018-19)

Time: 3 hours

Max marks: 70M

PART - I

Answer all the Questions. Each question carries 1 mark. 8x1=8M

4. Find the GCD of 18, 24.
5. Write the canonical form to find GCD of two numbers.
6. Define "a is congruent to b mod m".
7. Define multiplicative group.
8. Define quadratic residues
9. Define quadratic reciprocity
10. Define arithmetic function
11. Define the greatest integer function.

PART - II

Answer any Three questions from each section. Each question carries 5 marks. 6x5 =30M

SECTION – A

12. If (a, b) = 1 then prove that (a+b, a-b) is either 1 or 2
13. If c/ab and (b, c) =1 then prove that c/a.
14. Solve the congruence 25x ≡ 15 (mod 120).
15. If $a \equiv b \pmod{m}$, $c \equiv d \pmod{m}$ then prove that $ac \equiv bd \pmod{m}$.
16. State and prove Wilson's theorem

SECTION – B

17. If G is finite and $a \in G$ then prove that there is a positive integer $n < |G|$ such that $a^n = e$
18. Define Jocobi symbol.
19. Define multiplication groups and give example.

20. Prove that any complete residue system modulo m forms a group under addition modulo m.

21. Find all primes p such that $\left(\frac{10}{p}\right) = 1$

PART – III

Answer any four questions by choosing at least one question from each section. 4x8=32M

SECTION – C

19. State and prove Fundamental theorem of arithmetic.

20. State and prove Fermat's little theorem.

21. Let G=(a) be finite group of order n and let G' be a sub group of order m. Prove that m/n.

SECTION – D

22. Determine whether 219 is a quadratic residue or nonresidue mod 383.

23. Let p be an odd prime the prove that for all n, $\left(\frac{n}{p}\right) \equiv n^{p-1/2} (mod\ p)$

24. State and Prove mobius inversion formula.

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc. MATHEMATICS - Semester VI (w.e.f. 2018-19)

Course (Elective VII (D)): GRAPH THEORY

Total Hours of Teaching-Learning : 45 @ 3h/week **Total credits:03**

Objectives:

- To introduce the most application oriented field in Mathematics i.e., Graph Theory.
- To impart the awareness on applications of Graph Theory

UNIT I: Graphs and Subgraphs **(10 hrs)**

Graphs, Simple Graph, graph isomorphism, the incidence and adjacency matrices, sub graphs, vertex degree, Hand shaking theorem, paths and connection, cycles.

UNIT II : Applications, Trees: **(9 hrs)**

Applications, the shortest path problem, Sperner's lemma.
Trees, cut edges and bonds, cut vertices, Cayley's formula.

UNIT III : Applications of Trees, Connectivity: **(8 hrs)**

Applications of Trees – the connector problem.

Connectivity

Connectivity, Blocks and Applications, construction of reliable communication Networks.

UNIT IV: Euler Tours & Hamilton Cycles **(9hrs)**

Euler tours, Euler Trail, Hamilton path, Hamilton cycles, Dodecahedron graph, Peterson graph, Hamiltonian graph, closure of a graph.

UNIT V: Applications of Eulerian graphs **(9 hrs)**

Applications of Eulerian graphs, the Chinese postman problem, Fleury's Algorithm – the travelling salesman problem.

PRESCRIBED BOOK:

Graph Theory with Applications by J.A.Bondy and U .S.R. Murthy published by Mac. Millan Press.

REFERENCE BOOKS :

1. Graph theory with ApplicationsbyJ.A.Bondy and U.S.R.Murthy published by Mac.Millan Press
2. 2. Introduction to Graph theory by S.Arumugham and S.Ramachandran, published by Scitech Publications, Chennai-17
3. Graph theory and combinations by H.S.Govinda Rao published by Galgotia Publications

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SEMESTER-VI

PAPER –VII, Elective VII D

UNIT	TOPIC	V.S.A.Q	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Graphs and Subgraphs	02	01	01	15
II	Applications, Trees	01	02	01	19
III	Applications of trees, Connective	01	02	01	19
IV	Euler tours and Hamilton Cycles	02	03	01	25
V	Applications of Eulerian graphs	02	02	02	28
Total		08	10	06	106

V.S.A.Q. = Very Short answer questions (1mark)
S.A.Q.= Short answer questions (5 marks)
E.Q .= Essay questions (8 marks)

Very Short answer questions : 8x1M =08
Short answer questions : 6x5M =30
Essay questions : 4x8M = 32

Total Marks: 70

P.R.Government College (Autonomous), Kakinada

III Year B.Sc. Degree Examinations VI Semester MATHEMATICS

Course (Elective VII (D) GRAPH THEORY

PAPER VII MODEL PAPER (w.e.f. 2018-19)

Time: 3 hours Max marks: 70M

PART – I

Answer all the Questions. Each question carries 1 mark. 8x1=8M

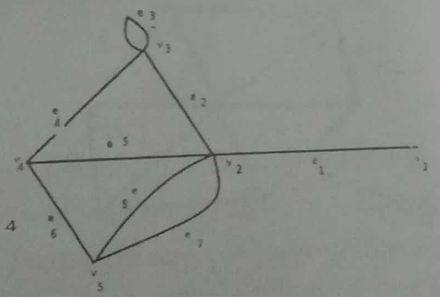
1. Define a simple graph.
2. When we say that the two vertices are adjacent.
3. How many edges have a tree with n vertices.
4. Define edge connectivity.
5. If a graph has an Euler trail then how many vertices have odd degree.
6. Define Hamiltonian Cycle.
7. For tracing which type of graph Fleury's algorithm.
8. Travelling Sales man problem is an application of which type of graph.

PART - II

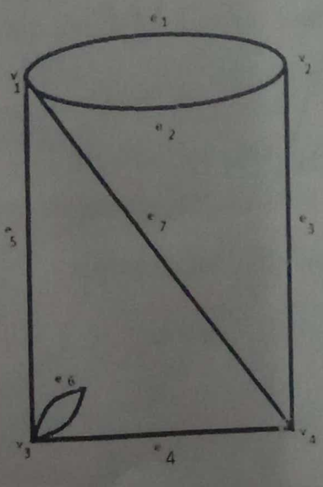
Answer any Three questions from each section. Each question carries 5 marks. 6x5 =30M

SECTION – A

9. Write the vertex set, edge set and degree of every vertex of the graph



10. Define incidence and adjacency matrix and write the incidence and adjacency matrices of the graph



11. Prove that in a tree, any two vertices are connected by a unique path.

12. If G is connected then prove that any two vertices of G lie on a common cycle.

13. Define the vertex cut and edge cut of a graph G(V,E) and give examples.

SECTION – B

14. Define Eulerian graph and give an example.

15. Draw the Dodecahedran graph and a Hamilton cycle of it.

16. Explain the Chinese post man problem.

17. Explain the travelling sales man problem.

18.) If G is a simple graph with $\nu \geq 3$ *and* $\delta \geq \frac{\nu}{2}$ then prove that G is Hamiltonian.

PART – III

Answer any four questions by choosing at least one question from each section. 4x8=32M

SECTION – C

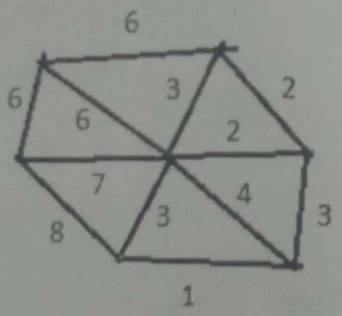
19. Define the degree of a vertex in a graph G and prove that the number of vertices of odd degree is even.

20. Write the Dijkastras algorithm for finding the shortest path between two vertices in a graph and give an example.

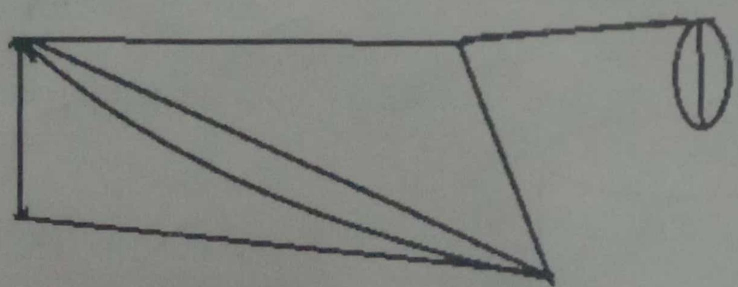
21. Prove that a connected graph is a tree if and only if every edge is a cut edge.

SECTION – D

22. Write the Kruskal's Algorithm for finding a minimal spanning tree and find a minimal spanning tree of the following graph.



23. Define blocks of a graph and draw the blocks of the following graph.



24. Write the Fleury's algorithm and give an example.

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc. MATHEMATICS - VI Semester, (w.e.f. 2018-19)

VII
Course (Cluster A -1) INTEGRAL TRANSFORMS

Total Hours of Teaching-Learning : 45 @ 3h/week   Total credits:03

Objectives:

- To be able to apply Laplace transform and inverse laplacetransform to find the solution of Ordinary Linear Differential Equations and Integral Equations.
- To understand the concepts of Infinite and Finite Fourier Transforms.
- To be able to find the Fourier transform of some functions.

UNIT – I Application of Laplace Transform to solutions of Differential Equations : (10 hrs)

Solutions of Differential Equations with constants co-efficient
Solutions of Differential Equations with Variable co-efficient

UNIT – II Application of Laplace Transform : (6 hrs)

Solution of simultaneous ordinary Differential Equations.
Solutions of partial Differential Equations.

UNIT – III Application of Laplace Transforms to Integral Equations : (8 hrs)

Definitions: Integral Equations-Abel's, Integral Equation-Integral Equation of Convolution Type, Integro Differential Equations -Application of L.T. to Integral Equations.

UNIT –IV Fourier Transforms-I : (11hrs)

Definition of Fourier Transform – Fourier's inverse Transform – Fourier cosine Transform – Linear Property of Fourier Transform – Change of Scale Property for Fourier Transform – sine Transform and cosine transform shifting property – modulation theorem.

UNIT – V Fourier Transform-II : (10hrs)

Convolution Definition – Convolution Theorem for Fourier transform – parseval'sIndentify – Relationship between Fourier and Laplace transforms – problems related to Integral Equations.

Finte Fourier Transforms : -

Finite Fourier Sine Transform – Finite Fourier Cosine Transform – Inversion formula for sine and cosine Transforms only statement and related problems.

Prescribed Text book:

Integral Transforms by A.R.Vasishta and R.K. Gupta, Krishnaprakasan media Pvt. Ltd. Meerat.

Reference Books:
Integral Transforms by Dr.J.K.Goyal and K.P.Gupta, PragatiPrakashan.
M.D.Raisinghania Integral Transform, S.Chand& Co., New Delhi.

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SEMESTER-VI
PAPER VIII (A) 1, CLUSTER VIII (A) 1

UNIT	TOPIC	V.S. A.Q	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Application of Laplace Transform to solutions of Differential Equations	01	02	01	19
II	Application of Laplace Transforms	01	01	01	14
III	Application of Laplace Transforms to Integral Equations	02	02	01	20
IV	Fourier Transforms-I	02	03	02	33
V	Fourier Transform-II	02	02	01	20
Total		08	10	06	106

V.S.A.Q. = Very Short answer questions (1mark)
S.A.Q.= Short answer questions (5 marks)
E.Q .= Essay questions (8 marks)

Very Short answer questions : 8x1M = 08
Short answer questions : 6x5M = 30
Essay questions : 4x8M = 32

Total Marks : 70

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III Year B.Sc. Degree Examinations VI Semester MATHEMATICS

Course (Cluster – VIII (A) -1) INTEGRAL TRANSFORMS

PAPER VIII (A) 1, MODEL PAPER (w.e.f. 2018-19)

Time: 3 hours | Max marks : 70M

PART - I

Answer all the Questions. Each question carries 1 mark. 8x1=8M

1. Write the formula of $L\{y''\}$
2. Find $L\left(\frac{\partial y}{\partial x}\right)$.
3. Write the Integral equation of convolution type.
4. Write the Abel's Integral Equation.
5. Write the Fourier Sine Transform of F(x).
6. Write the shifting property of Fourier Transform.
7. Find the cosine transform of $2e^{-5x}$
8. Write the Formula for finite Fourier Sine Transforms.

PART - II

Answer any Three questions from each section. Each question carries 5 marks. 6 x5=30M

SECTION – A

9. Solve $\frac{d^2y}{dx^2} + y = 0$ under the conditions that $y = 1, \frac{dy}{dx} = 0$ $when\ t = 0$.
10. Solve $(D^2 + 2D + 1)y = 3te^{-t}, t > 0$, subject to the conditions $y = 4, Dy = 2$ $when\ t = 0$.
11. Solve $(D^2 - 3)x - 4y = 0, x + (D^2 + 1)y = 0 \quad t > 0$ $If\ x = y = Dy = 0, Dx = 2\ when\ t = 0$.
12. Solve the integral equation $F(t) = e^{-t} - 2\int_0^t \cos(t-u)\, F(u)du$
13. Solve the integral equation $\int_0^t F(u)\, F(t-u)\, du = 16\, sin4t$.

SECTION – B

14. If $\tilde{f}(p)$ and $\tilde{g}(p)$ are Fourier Transforms of $f(x)$ and $g(x)$ respectively , then prove that
$$F\{af(x) + bg(x)\} = a\tilde{f}(p) + b\tilde{g}(p)$$
15. Find the Fourier Transform of $F(x) = \begin{cases} 1 - x^2, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$
16. Find the cosine transform of the function f(x), if
$$F(x) = \begin{cases} cosx, & 0 < x < a \\ 0, & x > a \end{cases}$$
17. Solve the integral equation $\int_0^\infty f(x) cos\lambda x\, dx = e^{-\lambda}$
18. Find the finite cosine transform of $(1 - \frac{x}{\pi})^2$.

PART – III

Answer any four questions by choosing atleast One from each section. **4x8=32M**

SECTION - C

19. Solve $(D+1)^2 y = t$ $give\ that\ y = -3, when\ \ t = 0\ and\ y = -1, when\ t = 1.$

20. Solve $\frac{\partial y}{\partial t} = 2\frac{\partial^2 y}{\partial x^2}$ where $y(0,t) = 0 = y(5,t)$ and $y(x,0) = 10\sin 4\pi x$

21. Solve the integral equation $\int_0^1 \frac{F(u)du}{(t-u)^{\frac{1}{3}}} = t(1+t)$

SECTION – D

22. Find the Fourier Cosine Transform of e^{-x^2}

23. State and Prove Parsvel's identity for Fourier Transforms.

24. Find the finite cosine transform of $f(x)$ if $f(x) = -\frac{\cos k(\pi - x)}{k\sin k\pi}$.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
III B.Sc. MATHEMATICS - VI Semester (w.e.f.2018-19)
Course (Cluster VIII (B)-1) Advanced Numerical Analysis

Total hours of teaching: 45 @ 3 hours/ week **Total credits: 3**

Objective:

- To find the integration and solutions for ordinary differential equations using numerical methods.
- To find the best fitted curve for the given data.

Unit – I Curve Fitting: **(8 hrs)**

Least – Squares curve fitting procedures, fitting a straight line, nonlinear curve fitting, Curve fitting by a sum of exponentials.

UNIT-II Numerical Differentiation: **(6 hrs)**

Derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formula, stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function.

UNIT- III Numerical Integration: **(10 hrs)**

General quadrature formula on errors, Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules, Euler – Maclaurin Formula of summation and quadrature, The Euler transformation.

UNIT – IV Solutions of simultaneous Linear Systems of Equations: **(11 hrs)**

Solution of linear systems – Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method ,Method of factorization, Solution of Tridiagonal Systems,. Iterative methods. Jacobi's method, Gauss- siedal method.

UNIT–V Numerical solution of ordinary differential equations: **(10 hrs)**

Introduction, Solution by Taylor's Series, Picard's method of successive approximations, Euler's method, Modified Euler's method, Runge – Kutta methods.

Reference Books :

1. Numerical Analysis by S.S.Sastry, published by Prentice Hall India (Latest Edition).
2. Numerical Analysis by G. Sankar Rao, published by New Age International Publishers, New Hyderabad.
3. Finite Differences and Numerical Analysis by H.C Saxena published by S. Chand and Company, Pvt. Ltd., New Delhi.
4. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar,

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SEMESTER-VI

PAPER VIII (B) 1, CLUSTER VIII (B) 1

UNIT	TOPIC	V.S.A.Q	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	Curve Fitting	01	02	01	19
II	Numerical Differentiation	01	01	01	14
III	Numerical Integration	02	02	01	20
IV	Solution of Linear System of Equations	02	03	01	25
V	Numerical Solutions for ODE	02	02	02	28
TOTAL		08	10	06	106

E.Q = Essay questions (8 marks)
S.A.Q = Short answer questions (5 marks)
V.S.A.Q = Very Short answer questions (1 mark)

Essay questions : 4x8M = 32
Short answer questions : 5x6M =30
Very Short answer questions : 8x1M =08

Total Marks : 70

P.R.Govt.College (Autonomous), Kakinada
III B.Sc Examination - VI Semester - Mathematics
(Cluster – VIII (B)-1) Advanced Numerical Analysis
PAPER-VIII (B) -1 MODEL PAPER (w.e.f. 2018-19)

Time: 3 hours Max marks=70M

PART-I

Answer all the questions. Each question carries 1 mark **8X1=8M**

1. Write the normal equations for fitting a straight line
2. Write the formula for $\frac{dy}{dx}$ at $x = x_1$.
3. Write Simpson's 3/8 formula.
4. Write ~~Boole's rule.~~ Euler Transformation Formula
5. ~~Write the formula of y_1, using Taylor's method.~~ What is the formula for A^{-1} for a non singular matrix A.
6. In factorization method if A=LU, then write L.
7. Write Euler's formula for y_n
8. Write the formula for Runge-Kutta method of second order

PART-II

Answer any three questions from each section **6X5=30 M**

SECTION –A

9. Find the least square line y=a+bx for the data.

Xi	1	2	3	4	5
Yi	14	27	40	55	68

10. Find the curve of best fit of the type $y=ae^{bx}$ to the following data by the method of least squares

x	1	5	7	9	12
y	10	15	12	15	21

11. From the following table, find x correct to 4 decimal plances for which y is minimum and find this value of y

X	0.60	0.65	0.70	0.75
Y	0.6221	0.6155	0.6138	0.6170

12. Evaluate $\int_0^1 x^3 dx$ with five sub-intervals by Trapezoidal rule.

13. Evaluate the $\int_0^{5.2} \log x dx$ using Weddle's Rule.

SECTION - B

14.Solve the equation x+y+z=6;3x+3y+4z=20;2x+y+3z=13 using Gaussian elimination method.

15. Solve the following equations by Gauss-Seidel method

$8x - 3y + 2z = 20; 4x + 11y - z = 33; 6x + 3y + 12z = 35;$

16. Solve the equations $2x_1 + x_2 + x_3 = 10: 3x_1 + 2x_2 + 3x_3 = 18:$

$x_1 + 4x_2 + 9x_3 = 16:$ Using Matrix inversion method.

17. Solve $\frac{dy}{dx} = x + y, y(0) = 1$, using Picard's method upto 3 approximations.

18. Using Euler's method solve for y at x=2 from $\frac{dy}{dx} = 3x^2 + 1, y(1) = 2$, taking step size h=0.25

PART-III

Answer any four questions by choosing at least one question from each section. 4X8=32

SECTION-C

19. Fit a second degree polynomial to the following data by the method of least squares:

X	0	1	2	3	4
Y	1	1.8	1.3	2.5	6.3

20. Form the following table of values of x and y, obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for x=1.5

X	1.5	2.0	2.5	3.0	3.5	4.0
Y	3.375	7.0	13.625	24.0	38.875	59.0

21.Derive Newton's general quadrature formula.

SECTION -D

22. Solve the equations 2x+3y+z=9;x+2y+3z=6;3x+y+2z=8 by factorization method.

23. Given $\frac{dy}{dx} = -xy^2, y(0) = 2,$ compute y(0.2) in steps of 0.1 using modified Euler's method.

24. Obtain the values of y at x=0.1,0.2 using Runge-kutta method of fourth order for the differential equation $y^1 + y = 0, y(0) = 1.$

P.R.GOVERNMENT COLLEGE (A), KAKINADA
B.Sc. THIRD YEAR MATHEMATICS - SEMESTER – VI (w.e.f. 2018-19)
Course : CLUSTER VIII- (C)-1 PRINCIPLES OF MECHANICS

No. Hours: 45hrs **Credits : 3**

Objectives:

- To understand the concepts of Mechanics which have applications in Physical problems.
- To Know the spherical co ordinate system.

Unit – I: **(8 hrs)**

D'Alembert's Principle and Lagrange's Equations : some definitions – Lagrange's equations for a Holonomic system – Lagrange's Equations of motion for conservative, nonholonomic system.

***Unit – II*:** **(10 hrs)**

Variational Principle and Lagrange's Equations: Variatonal Principle – Hamilton's Principle – Derivation of Hamilton's Principle from Lagrange's Equations – Derivation of Lagrange's Equations from Hamilton's Principle – Extension of Hamilton's Principle – Hamilton's Principle for Non-conservative, Non-holonomic system – Generalised Force in Dynamic System – Hamilton's Principle for Conservative, Non-holonomic system – Lagrange's Equations for Non- conservative, Holonomic system - Cyclic or Ignorable Coordinates.

***Unit –III*:** **(9 hrs)**

Conservation Theorem, Conservation of Linear Momentum in Lagrangian Formulation – Conservation of angular Momentum – conservation of Energy in Lagrangian formulation.

Unit – IV: **(11 hrs)**

Hamilton's Equations of Motion: Derivation of Hamilton's Equations of motion – Routh's procedure – equations of motion – Derivation of Hamilton's equations from Hamilton's Principle – Principle of Least Action – Distinction between Hamilton's Principle and Principle of Least Action.

Unit – V: **(7 hrs)**

Canonical Transformation: Canonical coordinates and canonical transformations – The necessary and sufficient condition for a transformation to be canonical – examples of canonical transformations – properties of canonical transformation – Lagrange's bracket is canonical invariant – poisson's bracket is canonical invariant - poisson's bracket is invariant under canonical transformation – Hamilton's Equations of motion in poisson's bracket – Jacobi's identity for poisson's brackets.

Reference Text Books :

1. Classical Mechanics by C.R.Mondal Published by Prentice Hall of India, New Delhi.

2. A Text Book of Fluid Dynamics by F. Charlton Published by CBS Publications, New Delhi.

3. Classical Mechanics by Herbert Goldstein, published by Narosa Publications, New Delhi.

4. Fluid Mechanics by T. Allen and I.L. Ditsworth Published by (McGraw Hill, 1972)

5. Fundamentals of Mechanics of fluids by I.G. Currie Published by (CRC, 2002)

6. Fluid Mechanics : An Introduction to the theory, by Chia-shun Yeh Published by (McGraw Hill, 1974)

7. Introduction to Fluid Mechanics by R.W Fox, A.T Mc Donald and P.J. Pritchard Published by (John Wiley and Sons Pvt. Ltd., 2003)

P.R.GOVERNMENT COLLEGE (A), KAKINADA
B.Sc. THIRD YEAR MATHEMATICS - SEMESTER – VI (w.e.f. 2018-19)
Course : CLUSTER VIII- (C)-2 FLUID MECHANICS

No. Hours: 45hrs **Credits : 3**

Objectives:

- To understand the concepts of Fluid Mechanics which have applications in water flow, blood flow etc.
- To Know the recent advances in fluid dynamics.

Unit I: **(9 hrs)**

Kinematics of Fluids in Motion

Real fluids and Ideal fluids – Velocity of a Fluid at a point – Streamlines and pthlines – steady and
Unsteady flows – the velocity potential – The Vorticity vector – Local and Particle Rates of Change
– The equation of Continuity – Acceleration of a fluid – Conditions at a rigid boundary – General
Analysis of fluid motion.

Unit – II : **(8 hrs)**

Equations of motion of a fluid- Pressure at a point in fluid at rest – Pressure at a point in a moving fluid – Conditions at a boundary of two inviscid immiscible fluids – Euler's equations of motion – Bernoulli's equation – Worked examples.

Unit – III : **(8 hrs)**

Discussion of the case of steady motion under conservative body forces - Some flows involving axial symmetry – Some special two-dimensional flows – Impulsive motion – Some further aspects of vortex motion.

Unit – IV : **(10 hrs)**

Some Two – dimensional Flows, Meaning of two-dimensional flow – Use of Cylindrical polar coordinates – The stream function – The complex potential for two-dimensional, Irrotational, Incompressible flow – Uniform Stream – The Milne-Thomson Circle theorem – the theorem of Blasius.

Unit – V : **(10 hours)**

Viscous flow,Stress components in a real fluid – Relations between Cartesian components of stress – Translational motion of fluid element – Thes rate of strain quadric and principal stresses

– Some further properties of the rate of strain quadric – Stress analysis in fluid motion – Relations between stress and rate of strain – the coefficient of viscosity and laminar flow - The Navier- Stokes equations of motion of a viscous fluid.

<u>Reference Text Books :</u>

1. A Text Book of Fluid Dynamics by F. Charlton Published by CBS Publications, New Delhi.

2. Classical Mechanics by Herbert Goldstein, published by Narosa Publications, New Delhi.

3. Fluid Mechanics by T. Allen and I.L. Ditsworth published by (McGraw Hill, 1972)

4. Fundamentals of Mechanics of fluids by I.G. Currie published by (CRC, 2002)

5. Fluid Mechanics, An Introduction to the theory by Chia-shun Yeh published by (McGraw Hill,

1974)

6. Fluids Mechanics by F.M White published by (McGraw Hill, 2003)

7. Introduction to Fluid Mechanics by R.W Fox, A.T Mc Donald and P.J. Pritchard published by

(John Jiley and Sons Pvt. Ltd., 2003)

P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc. MATHEMATICS - VI Semester (w.e.f. 2018-19)

Course (Elective VIII (D)-1) : APPLIED GRAPH THEORY

Total Hours of Teaching-Learning : 45 @ 3h/week **Total credits:03**

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Objectives:

- To introduce the most application oriented field in Mathematics i.e., Graph Theory.
- To impart the awareness on applications of Graph Theory

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Unit – I Matchings: **(9 hrs)**

Matchings – Alternating Path, Augmenting Path – Matchings and coverings in Bipartite graphs, Marriage Theorem, Minimum Coverings.

Unit – II Perfect matchings: **(9 hrs)**

Perfect matchings, Tutte's Theorem, Applications, The Personal Assignment problem – The optimal assignment problem, Kuhn-Munkres Theorem,

Unit – III Edge Colorings: **(6 hrs)**

Edge Chromatic Number, Edge Coloring in Bipartite Graphs – Vizing's theorem.

Unit – IV Applications of Matchings, Independent sets and Cliques: **(10 hrs)**

Applications of Matchings, The timetable problem.

Independent sets, Covering number, Edge Independence Number,Edge Covering Number-Ramsey's theorem.

Unit – V Ramsey's Number: **(11 hrs)**

Determination of Ramsey's Numbers – Erdos Theorem, Turan's Theorem and Applications, Sehur's theorem. A geometry problem.

PRESCRIBED BOOK:

Graph Theory with Applications by J.A.Bondy and U .S.R. Murthy published by Mac. Millan Press.

REFERENCE BOOKS :

1. Graph theory with ApplicationsbyJ.A.Bondy and U.S.R.Murthy published by Mac.Millan Press
2. 2. Introduction to Graph theory by S.Arumugham and S.Ramachandran, published by Scitech Publications, Chennai-17
3. Graph theory and combinations by H.S.Govinda Rao published by Galgotia Publications

BLUE PRINT FOR QUESTION PAPER PATTERN, SEMESTER-VI PAPER –VIII (D)-1, Cluster VIII D - 1

UNIT	TOPIC	V.S.A.Q	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Matchings	02	02	01	20
II	Perfect matchings	01	01	01	14
III	Edge Colorings	01	02	01	19
IV	Applications of Matchings, Independent sets and Cliques	02	03	01	25
V	Ramsey's Number	02	02	02	28
Total		08	10	06	106

V.S.A.Q. = Very Short answer questions (1mark)
S.A.Q.= Short answer questions (5 marks)
E.Q .= Essay questions (8 marks)

Very Short answer questions	:	8x1M =08
Short answer questions	:	6x5M =30
Essay questions	:	4x8M = 32
Total Marks:		70

P.R.Government College (A), Kakinada

III year B.Sc. Examination -Semester VI - Mathematics

Cluster -VIII (D) 1: Applied Graph Theory

PAPER VIII (D) 1 (MODEL PAPER w.e.f. 2018-19)

Time: 3 hours | Maximum Marks: 75

PART – I

Answer the following questions. Each question carries ONE mark. **8x1=8 M**

1. Define a matching.
2. Give an example of a bipartite graph.
3. State the Tutte's Theorem.
4. State the Vizing's theorem.
5. Define an independent set.
6. State the Ramsey's theorem
7. State the Erdos Theorem.
8. State the Turan's Theorem.

PART – II

Answer any SIX questions by choosing at least Three from each section. **6x5=30 M**

SECTION - A

9. Define and give example of maximum and Perfect matching in graphs.
10. Define and give example of M-Alternating Path and Covering of a graph.
11. Prove that every 3-regular graph with out cut edges has a perfect matching
12. Define an M-alternating tree and give an example.
13. Define Proper k- edge coloring and give an example.

SECTION – B

14. Explain the time table problem with an example.
15. A set $S \subseteq V$ is an independent set of G if and only if V/S is a covering of G.
16. Define edge independence and edge covering numbers with examples.
17. Give an example of (3,5) – Ramsey graph.
18. State and Prove Sehur's theorem.

PART – III

Answer any FOUR questions by choosing at least one from each section. **4x8=32 M**

SECTION – C

19. In a bipartite graph, prove that the number of edges in a maximum matching is equal to the number of vertices in a minimum covering.

20. Write the Kuhn – Munkers Algorithm.

21. If G is bipartite, then prove that $X' = \Delta$.

SECTION – D

22. If $\delta > 0, then\ prove\ that\ \alpha' + \beta' = \nu$.

23. Prove that $r(k, l) \leq \binom{k + l - 2}{k - 1}$.

24. If a simple graph G contains no K_{m-1}, then prove that G is degree majorised by some complete m-partite graph H.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
B.Sc. THIRD YEAR MATHEMATICS - SEMESTER – VI (w.e.f. 2017-18)
Course : CLUSTER VIII- (A,B,D)-2 SPECIAL FUNCTIONS

No. Hours: 45hrs **Credits : 3**

Objectives:

- To understand the concepts of special functions which have applications in Physical Sciences.
- To learn finding power series solutions to some special types of differential equations.

UNIT-I HERMITE POLYNOMIAL: **(9 hrs)**

Hermite Differential Equations, Solution of Hermite Equation, Hermite's Polynomials, Generating function, Other forms for Hermite Polynomial, To find first few Hermite Polynomials, Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials. CHAPTER: 6.1 to 6.8

UNIT-II LAGUERRE POLYNOMIALS: **(9 hrs)**

Laguerre's Differential equation, Solution of Laguerre's equation, Laguerre Polynomials, Generating function, Other forms for the Laguerre Poynomials, To find first few Laguerre Polynomials,Orthogonal property of the Laguerre Polynomials, Recurrence formula for Laguerre Polynomials, Associated Laguerre Equation. CHAPTER: 7.1 to 7.9

UNIT-III LEGENDRE'S EQUATION: **(9 hrs)**

Definition, Solution of Legendre's Equation, Definition of $P_n(x)$ and $Q_n(x)$. General solution of Legendre's Equation(derivationis not required)To show that $P_n(x)$ is the coefficient of h^n in the expansion of $(1-2xh+h^2)^{1/2}$, Orthogonal properties of Legendre's Equation, Recurrence formulae, Rodrigues formula, CHAPTER: 2.1 to,2.8,2.12,

UNIT-IV BESSEL'S EQUATION: **(9 hrs)**

Definition, Solution of Bessel's General Differential Equations, General solution of Bessel's Equation, Integration of Bessel's equation in series for n=0,Definition of , $J_n(x)$ Recurrence formulae for $J_n(x)$, Generating function for $J_n(x)$ CHAPTER: 5.1 to 5.7

UNIT-V BETA AND GAMMA FUNCTIONS: **(9 hrs)**

Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions,Another form of Beta Function, Relation between Beta and Gamma Functions, Other Transformations. CHAPTER: 2.9 to 2.15

Prescribed text book: Special Functions by J.N.Sharma and Dr.R.K.Gupta.

BLUE PRINT FOR QUESTION PAPER PATTERN.

SEMESTER-VI, CLUSTER VIII –A, B,D -2

SPECIAL FUNCTIONS

UNIT	TOPIC	V.S.A.Q 1 M	S.A.Q (including choice) 5 M	E.Q (including choice) 8 M	Marks Allotted
I	HERMIT POLYNOMIAL	01	02	01	19
II	LAGUERRE POLYNOMIAL	01	02	01	19
III	LEGENDRE'S EQUATION	02	02	01	20
IV	BESSEL'S EQUATION	02	02	01	20
V	BETA AND GAMA FUNCTIONS	02	02	02	28
Total		08	10	06	106

V.S.A.Q. = Very Short answer questions (1mark)
S.A.Q.= Short answer questions (5 marks)
E.Q .= Essay questions (8 marks)

Very Short answer questions : 8x1M = 08
Short answer questions : 6x5M = 30
Essay questions : 4x8M = 32

Total Marks : 70

P.R.Government College (A), Kakinada
III B.Sc. Degree Examinations: Semester-VI, Mathematics
COURSE (Cluster VIII (A,B,D) 2) Special Functions

PAPER-VIII A,B, D 2 (MODEL PAPER w.e.f.2017-2018)

Time: 3 hours Max. marks : 70M

PART - I

Answer the following questions **8 x 1 = 8 M**

1. Write the generating function of Hermit's polynomial.
2. Show that $L_1(x) = 1 - x$.
3. Define Legendre's equation.
4. Show that $P_n(1) = 1$.
5. Define Bessel's equation.
6. Write $J_0(x)$.
7. Show that $\Gamma(1) = 1$.
8. Define Beta function.

PART - II

Answer any SIX questions by choosing three from each section. **6x5=30 M**

SECTION – A

9. Evaluate $\int_{-\infty}^{\infty} xe^{-x^2} H_n(x).H_m(x)$.
10. Prove that $H_{2n}(0) = (-1)^n \frac{(2n)!}{n!}$.
11. Show that $L_2(x) = \frac{1}{2!}(2 - 4x + x^2)$
12. Show that $L_n(x) = \frac{e^x}{n!}\frac{d^n(x^n e^{-x})}{dx^n}$.
13. Prove that $P_3(x) = \frac{1}{2}(5x^3 - 3x)$.

SECTION – B

14. Show that $\int_{-1}^{1} P_m(x).P_n(x)\,dx = 0 \; if \; m \neq n$.
15. Prove that $J_{-n}(x) = (-1)^n J_n(x)$.
16. Show that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$.
17. Evaluate $\int_0^a x^4\sqrt{a^2 - x^2}\,dx$.
18. Evaluate $\int_0^{\infty} \frac{x^8(1-x^6)}{(1+x)^{24}}\,dx$.

PART - III

Answer any FOUR questions by choosing at least one from each section. **6x5=30 M**

SECTION – C

19. State and Prove Rodrigue's formula for $H_n(x)$.
20. Prove that $xL_n''(x) + (1-x)L_n'(x) + nL_n(x) = 0$
21. Prove that $(2n+1)xP_n = (n+1)P_{n+1} + nP_{n-1}$.

SECTION –D

22. Prove that $xJ_n'(x) = nJ_n(x) - xJ_{n+1}(x)$.
23. When n is a positive integer, prove that $\Gamma\left(-n+\frac{1}{2}\right) = \frac{(-1)^n 2^n \sqrt{\pi}}{1.3.3\ldots(2n-1)}$
24. Prove that $B(l,m) = \frac{\Gamma(l)\Gamma(m)}{\Gamma(l+m)}$

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P.R.GOVERNMENT COLLEGE (A), KAKINADA

DEPARTMENT OF MATHEMATICS AND STATISTICS

PROBLEMS FOR PROBLEM SOLVING SESSION IN SPECIAL FUNCTIONS

1. HERMITE POLYNOMIALS - I

1. State and Prove generating function of the Hermit's polynomial.
2. State and Prove Rodrigues formula for $H_n(x)$.
3. Find Hermite Polynomials for n=0, 1, 2, 3, 4 and 5.
4. State and Prove Orthogonal Properties of Hermite Polynomials.

2. HERMITE POLYNOMIALS - II

1. Prove that $2xH_n(x) = 2nH_{n-1}(x) + H_{n+1}(x)$
2. Prove that $H_n'' = 4n(n-1)H_{n-2}$
3. Prove that $H_n'(x) = 2xH_n(x) - H_{n+1}(x)$
4. Prove that, if $m < n$, $\frac{d^m}{dx^m}\{H_n(x)\} = \frac{2^m n!}{(n-m)!}H_{n-m}(x)$.

3. LAGUERRE POLYNOMIALS

1. Prove that $\frac{1}{1-t}e^{-tx/(1-t)}$ is the generating function of Laguerre Polynomial.
2. Find the Laguerre Polynomials for n=0, 1, 2, 3, 4
3. State and Prove Orthogonal Property of Laguerre polynomial.
4. Prove that $(n+1)L_{n+1}(x) = (2n+1-x)nL_n(x) - L_{n-1}(x)$.

4.LEGENDRE'S EQUATION

1. Show that $P_n(x)$ is the co efficient of h^n in the expansion in ascending powers of $(1-2xh+h^2)^{-1/2}$.
2. State and Prove orthogonal properties of Legendre's Polynomial.
3. Prove that $(2n+1)xP_n = (n+1)P_{n+1} + nP_{n-1}$.
4. Prove that $nP_n = xP_n' - P_{n-1}'$.

5. BESSEL'S EQUATIONS - I

1. Prove that $xJ_n'(x) = nJ_n(x) - xJ_{n+1}(x)$.
2. Prove that $xJ_n'(x) = -nJ_n(x) + xJ_{n-1}(x)$.
3. Prove that $\frac{d}{dx}[x^{-n}J_n(x)] = x^{-n}J_{n+1}(x)$
4. When n is a positive integer then prove that $J_n(x)$ is the co efficient of z^n in the expansion of $e^{x\left(z-\frac{1}{z}\right)/2}$ in ascending and decending powers of z.

6. BESSEL'S EQUATIONS – II

1. Show that when n is a positive integer (i) $J_{-n}(x) = (-1)^n J_n(x)$ and (ii) $J_n(-x) = (-1)^n J_n(x)$ for positive or negative integers.
2. Prove that $\frac{d}{dx}(xJ_nJ_{n+1}) = x(J_n^2 - J_{n+1}^2)$
3. Prove that $\sqrt{\frac{\pi x}{2}} J_{3/2}(x) = \frac{1}{x}\sin x - \cos x$.
4. Show that $\cos x = J_0 - 2J_2 + 2J_4 - \cdots ....$ and $\sin x = 2J_1 - 2J_3 + 2J_5 - \cdots ...$

7. GAMMA FUNCTIONS AND BETA FUNCTIONS - 1

1. When n is a positive integer, prove that $\Gamma\left(-n + \frac{1}{2}\right) = \frac{(-1)^n 2^n \sqrt{\pi}}{1.3.5.....(2n-1)}$
2. Show that $2^n \Gamma\left(n + \frac{1}{2}\right) = 1.3.5 \ldots . (2n-1)\sqrt{\pi}$
3. Prove that $\int_0^1 x^m (\log x)^n dx = \frac{(-1)^n n!}{(m+1)^{n+1}}$
4. Prove that $\Gamma(n) = \frac{1}{n}\int_0^\infty e^{-y^{1/n}} dy$ *and hence show that* $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$

8. GAMMA FUNCTIONS AND BETA FUNCTIONS - 2

1. Prove that $B(l, m) = \frac{\Gamma(l).\Gamma(m)}{\Gamma(l+m)}$
2. Evaluate $\int_0^2 x(8 - x^3)^{1/3} dx$.
3. Show that $\Gamma\left(\frac{3}{2} - x\right)\Gamma\left(\frac{3}{2} + x\right) = \left(\frac{1}{4} - x^2\right)\pi \sec \pi x$ provided $-1 < 2x < 1$.
4. Show that (i) $\Gamma\left(\frac{1}{4}\right)\Gamma\left(\frac{3}{4}\right) = \pi\sqrt{2}$ (ii) $\Gamma(x)\Gamma(-x) = -\frac{\pi}{x \sin \pi x}$

LIST OF EXAMINERS & PAPER SETTERS IN MATHEMATICS

S.No.	Name of the Lecturer	Address
1	Sri M.VenkataRao	Lecturer in Mathematics, Government Degree College, Nidadavolu
2	Sri K.VenkataRao	Lecturer in Mathematics, Government Degree College, Alamuru.
3	Dr.D.Chitti Babu	Lecturer in Mathematics, Government Degree College, Tadepalligudem.
4	Smt. Gayatri	Lecturer in Mathematics, Government College (A), Rajamahendravaram.
5	Dr. P. Subhashini	Lecturer in Mathematics, Government Degree College, Ramachandrapuram.
6	Dr. D.Sai Baba	Lecturer in Mathematics, Sri YN College (A), Narasapur.
7	Dr. A.S.K.Chandra Shekar	Lecturer in Mathematics, DNR College (A), Bheemavaram.
8	Smt. K. Parameswari	Lecturer in Mathematics, Government Degree College, Ganapavaram.
9	Dr.Ch. Srinivas	Lecturer in Mathematics, Government College (A), Rajamahendravaram
10	Sri K.Chitti Babu :	Lecturer in Mathematics, Government Degree College, Ramachandrapuram.
11	Capt.K.Rama Krishna	Lecturer in Mathematics, Ms A.V.N College, Visakhapatanam.
12	Dr. V.S. Patnayak	Lecturer in Mathematics, M.R College, Vizaianagaram
13	Sri K. Kameswara Rao	Lecturer in Mathematics, Government Degree College, Nidadavolu.
14	Ms. Y. Padmaja	Lecturer in Mathematics, Government Degree College, Pithapuram

P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF MATHEMATICS AND STATISTICS
WORK LOAD FOR THE YEAR 2018-19 (ODD SEMESTERS)

Name of the Subject : Mathematics
Total No. of Hours : **202** (actual)

No. of Permanent posts sanctioned : 04

No. of Permanent staff working : 01

No. of Contract faculty : 00

No. of Part – Time Faculty : 04

S. No	Name of the class	No. of Theory hours	No. of Practical Hours	No.of Batches	Total Practical Hours	Total hrs.(Theory + Practical)	Names of the Faculty allotted to the class
1	I MPC (TM)	6				6	
2	I MPC EM	6				6	
3	I MCPc	6				6	
4	I MPE	6				6	
5	I MCCs	6				6	
6	I MPCS	6				6	
7	IMECS	6				6	
8	I MSCs	6				6	60
9	I MS Actuarial	6				6	
10	II MPC (TM)	6				6	
11	II MPC EM	6				6	
12	II MCPc	6				6	
13	II MPE	6				6	
14	II MCCs	6				6	
15	II MPCS	6				6	54
16	II MECS	6				6	60
17	II MSCs	6				6	
18	II MS Actuarial	6				6	
19	III MPC (TM)	3+3	2+2	2	8	14 10	
20	III MPC EM	3+3	2+2	1	4	10	
21	I II MCPc	3+3	2+2	1	4	10	
22	III MPE	3+3	2+2	1	4	10	
23	III MCCs	3+3	2+2	1	4	10	
24	III MPCS	3+3	2+2	1	4	10	90
25	III MECS	3+3	2+2	1	4	10	
26	III MSCs	3+3	2+2	1	4	10	
27	III MS Actuarial	3+3	2+2	1	4	10	
Total Work load for the subject Mathematics						**202**	210

60
60
90
210

P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

DEPARTMENT OF MATHEMATICS AND STATISTICS

WORK LOAD FOR THE YEAR 2018-2019 (ODD SEMESTER)

Name of the Subject : Mathematics

Total No. of Hours : **102** (adjusted)

No. of Permanent posts sanctioned : 04

No. of Permanent staff working : 01

No. of Contract faculty : 00

No. of Guest Faculty : 04

S. No	Name of the class	No. of Theory hours	No. of Practical Hours	No.of Batches	Total Practical Hours	Total hrs.(Theory + Practical)	Names of the Faculty allotted to the class
1	I MPC (TM)	6	-	-	-	6	
2	I MPC EM, MPE, MCA	6	-	-	-	6	
3	I MCPc, MASAs	6	-	-		6	
4	I MPCs, MECs	6	-	-	-	6	
5	I MSCs, MCCs	6	-	-	-	6	
6	II MPC (TM)	6	-			6	
7	II MPC EM, MPE	6				6	
9	II MCPc, MAS	6				6	
10	II MPCs, MECs,	6				6	
11	II MSCs, MCCs	6				6	
12	IIIMPC (TM)	5+5	2+2	2	8	14 / 10	
13	III MPC EM, MCPc, MCCs, MAS	6	2+2	2	8	14	
11	III MPCs, MECs, MSCs, , MPE	6	2+2	2	8	14	
	Total Work load for Mathematics					102 110	

30
30
30
110

In addition to these hours there are activity hours @ 2 hours for each class for 1st and 2nd years, 1 hour for 3rd year.

13 III MPC EM, MPE - 5+5 10

14. III MCPC MSAS 10

15 III MPCs, MECs 10

16 III MSCs, MCCs 10

P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF MATHEMATICS AND STATISTICS
WORK LOAD FOR THE YEAR 2018-19 (EVEN SEMESTERS)

Name of the Subject : Mathematics
Total No. of Hours : **197** (actual)
No. of Permanent postssanctioned : 04
No. of Permanent staff working : 01
No. of Contract faculty : 00
No. of Part – Time Faculty : 04

S. No	Name of the class	No. of Theory hours	No. of Practical Hours	No.of Batches	Total Practical Hours	Total hrs.(Theory + Practical)	Names of the Faculty allotted to the class
1	I MPC (TM)	6				6	
2	I MPC EM	6				6	
3	I MCPc	6				6	
4	I MPE	6				6	
5	I MCCs	6				6	
6	I MPCS	6				6	
7	IMECS	6				6	
8	I MSCs	6				6	
9	I MS Actuarial	6				6	
10	II MPC (TM)	6				6	
11	II MPC EM	6				6	
12	II MCPc	6				6	
13	II MPE	6				6	
14	II MCCs	6				6	
15	II MPCS	6				6	
16	II MECS	6				6	
17	II MSCs	6				6	
18	II MS Actuarial	6				6	
19	III MPC (TM)	3	2	2	4	7	
20	III MPC EM	3	2	1	2	5	
21	I II MCPc	3	2	1	2	5	
22	III MPE	3	2	1	2	5	
23	III MCCs	3	2	1	2	5	
24	III MPCS	3	2	1	2	5	
25	III MECS	3	2	1	2	5	
26	III MSCs	3	2	1	2	5	
27	III MS As	3	2	1	2	5	
	Maths cluster	3+3	2+2	1	4	10	
	Project work	5	-	-	-	5 for each project	
	I MSAs Financial Mathematics	3	-	-	-	3	
28	Analytical Skills	24	-	-	-	24	
	Total Work load for the department of Mathematics					197	

P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

DEPARTMENT OF MATHEMATICS AND STATISTICS

WORK LOAD FOR THE YEAR 2018-19 (EVEN SEMESTER)

Name of the Subject	: Mathematics
Total No. of Hours	: **117** (adjusted)
No. of Permanent posts sanctioned	: 04
No. of Permanent staff working	: 01
No. of Contract faculty	: 00
No. of Guest Faculty	: 04

S. No	Name of the class	No. of Theory hours	No. of Practical Hours	No.of Batches	Total Practical Hours	Total hrs.(Theory + Practical)	Names of the Faculty allotted to the class
1	I MPC (TM)	6	-	-	-	6	
2	I MPC EM, MPE, MCAC	6	-	-	-	6	
3	I MCPc, MAS	6	-	-		6	30
4	I MPCs, MECs	6	-	-	-	6	
5	I MSCs, MCCs	6	-	-	-	6	
6	II MPC (TM)	6	-			6	
7	II MPC EM, MPE, MCAC	6				6	
8	II MCPc, MAS	6				6	30
9	II MPCs, MECs,	6				6	
10	II MSCs, MCCs	6				6	
11	IIIMPC (TM)	3	2	2	4	7	
12	III MPC EM, MCPc, MPE, MSAs	3	2	2	4	7	25
13	III MPCs, MECs, MSCs, , MCCs	3	2	2	4	7	
14	**Maths cluster**	3+3	2+2	1	4	10	10
15	**Project work**	5				5 for each project	5
16	**I MSAs**	3				3	
17	Analytical Skills	2				18	12
	Total Work load for Mathematics					117	112

In addition to these hours there are activity hours @ 2 hours for each class for 1st and 2nd years, 1 hour for 3rd year.

P. R. GOVT. COLLEGE (A), KAKINADA
ACTION PLAN FOR THE ACADEMIC YEAR 2018-19
DEPARTMENT OF MATHEMATICS & STATISTICS

S. No	Months	Week	Item as approved in BOS and to be incorporated in AC Meeting agenda as Institution Plan	Outcome of the activity
1	June, 2018	IV	Celebration of National Statistics Day on 29th of June	Students will get awareness about the practical utilization of Statistics through the interaction with NSSO officers.
2	July, 2018	II	Mathematics Extension Lecture	Students Knowledge will be updated
3	August, 2018	III	Extension Lecturer in Statistics	The knowledge of students will be enriched
4	September 2018	I	Extension Lecturer in Actuarial Science	Students are able to understand the role of insurance in real world.
5	December 2018	II	Town level Quiz and elocution computations	The competitive spirit will be improved among the students.
6	December 2018	II	Competitions to school children	The children may be inspired and put more concentration in Mathematics
7	December 2018	III	Celebration of Mathematics Day on 22nd Dec -2018	The students will be motivated to pursue higher education in Mathematics.
8	January, 2019	I	Extension lecture in Actuarial Science	Interest will be created on this new subject among the students
9	February, 2019	IV	Science day celebrations	Students will get more interest to do projects and there is a scope to know the applicability of all subjects.
10	March, 2019	II	π Day celebrations	To import the knowledge on the significance of π.