K.S.Rangasamy College of Arts and Science(Autonomous),

Tiruchengode-637 215

Department of Mathematics –PG

Elective Courses

- Design theory
- Stochastic Process
- Difference Equations
- Control Theory
- Neural Networks
- Number Theory

Encls:

1.Copy of Scheme of Examination.

2.Syllabus copy of courses highlighting the Elective along with course outcomes.

3.Mapping of courses to Elective.

HOD –PG Mathematics

Head, P.G. Department of Mathematics,
K.S. Rangasamy College of Arts and Science
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Tiruchengode - 637 215.

K.S.RANGASAMY COLLEGE OF ARTS & SCIENCE (AUTONOMOUS) CONTROLLER OF EXAMINATIONS TIRUCHENGODE-637 215.

COE

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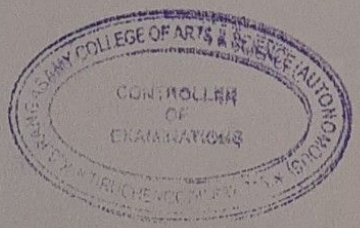
Tiruchengode - 637 215. Tamilnadu. India.

SCHEME OF EXAMINATION

Subject Code	Subject	Hrs of Instruction	Exam. Duration (Hours)	Max.marks			Credit Points
				CA	CE	Total	
FirstSemester							
	Part A						
18PMAM101	Core I: Linear Algebra	6	3	25	75	100	5
18PMAM102	Core II: Real Analysis	5	3	25	75	100	4
18PMAM103	Core III: Mechanics	6	3	25	75	100	4
18PMAM104	Core IV: Ordinary Differential Equations	5	3	25	75	100	4
18PMAM105	Core V: Graph Theory	5	3	25	75	100	4
18PMAMP101	Core Practical I: Mathematical Text Editor Latex	2	3	40	60	100	2
	Non – Credit						
18PLS101	Career Competency Skills I	1	---	---	---	---	---
	Total	**30**				**600**	**23**
Second Semester							
	Part A						
18PMAM201	Core VI: Algebra	6	3	25	75	100	5
18PMAM202	Core VII: Topology	6	3	25	75	100	5
18PMAM203	Core VIII: Measure Theory and Integration	5	3	25	75	100	4
18PMAM204	Core IX: Partial Differential Equations	5	3	25	75	100	4
	Elective I	5	3	25	75	100	4
	Part B						
18PVE201	Value Education: Human Rights	2	3	25	75	100	2
	Non – Credit						
18PLS201	Career Competency Skills II	1	---	---	---	---	---
	Total	**30**				**600**	**24**

M.P.



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Third Semester							
Subject Code	**Subject**	**Hours/ week**	**Exam. Duration (Hours)**	**Max.marks**			**Credit Points**
				CA	CE	Total	
Part A							
18PMAM301	Core X: Complex Analysis	6	3	25	75	100	5
18PMAM302	Core XI: Fluid Dynamics	6	3	25	75	100	5
18PMAM303	Core XII: Optimization Techniques	6	3	25	75	100	4
	Elective II	5	3	25	75	100	4
18PCSMAI301	IDC: Programming in C++	4	3	25	75	100	2
18PCSMAIP301	IDC Practical: Programming in C++	3	3	40	60	100	2
	Total	**30**				**600**	**22**
Fourth Semester							
Part A							
18PMAM401	Core XIII: Functional Analysis	6	3	25	75	100	5
18PMAM402	Core XIV: Integral Equations and Calculus of Variations	6	3	25	75	100	4
18PMAM403	Core XV: Numerical Analysis	6	3	25	75	100	4
18PMAM404	Core XVI: Fuzzy Sets and Fuzzy Logic	5	3	25	75	100	4
18PMAM405	Core XVII: MATLAB	4	3	25	75	100	2
18PMAMP401	Core Practical II: MATLAB	3	3	40	60	100	2
	Total	**30**				**600**	**21**
					Grand Total	**2400**	**90**

P.S.R. RANGASAMY COLLEGE OF ARTS & SCIENCE (AUTONOMOUS) CONTROLLER OF EXAMINATIONS TIRUCHENGODE-637 215.

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ELECTIVE SUBJECTS:

Students shall opt an elective subject from the list of ELECTIVE I (SEMESTER II)

ELECTIVE I (SEMESTER II)

S.No	Subject Code	Subject
1	18PMAEL201	Design Theory
2	18PMAEL202	Stochastic process
3	18PMAEL203	Difference Equations

Students shall opt an elective subject from the list of ELECTIVE II (SEMESTER III).

ELECTIVE II (SEMESTER III)

S.No	Subject Code	Subject
1	18PMAEL301	Control Theory
2	18PMAEL302	Neural Networks
3	18PMAEL303	Number Theory

FOR COURSE COMPLETION

Students shall

- Complete all Major papers
- Opt any one Elective Subject in each of Second and Third semester.
- Complete one value education in Second semester.
- Career Competency Skills papers as non credit course in I and II semester.
- Complete one IDC in Third semester.

TOTAL CREDIT DISTRIBUTION

Components	Total Marks		Credits
Core	100X17 PAPERS	1700	72
Elective	100X2 PAPERS	200	8
IDC	100X1 PAPER	100	2
Core Practical	100X2 PAPERS	200	4
IDC Practical	100X1 PAPER	100	2
Value Education	100X1 PAPER	100	2
Total	**No. of papers 24**	**2400**	**90**

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18PMAEL201	ELECTIVE I: DESIGN THEORY	SEMESTER – II

Course Objectives:

The Course aims

- To study about Steiner triple systems
- To Introduce mutually orthogonal Latin squares

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs.	CO
I	**Steiner Triple Systems:** The existence problem – The Bose construction – Skolen construction – The 6n+5 construction – The Wilson construction – Cyclic Steiner triple systems. **(Chapter - 1 Section: 1.1 – 1.4, 1.6, 1.7)**	10	CO 1
II	**λ-Fold Triple Systems:** Triple system of index $\lambda > 1$ – The existence of idempotent Latin squares – 2 fold triple systems – Mendelsohn triple systems –λ=3 and 6 – λ-fold triple systems in general. **(Chapter - 2 Sections: 2.1– 2.6)**	10	CO 2
III	**Maximum Packings and Minimum Coverings:** The general problem – Maximum packings – Minimum coverings. **(Chapter - 4 Sections: 4.1 – 4.3)**	10	CO 3
IV	**Kirkman Triple Systems:** A recursive construction – Constructing pairwise balanced designs. **(Chapter - 5 Sections: 5.1 – 5.2)**	10	CO 4
V	**Mutually Orthogonal Latin Squares:** Introduction – The Euler and MacNeish Conjectures – Disproof of the MacNeish Conjecture – Disproof of Euler conjecture – Orthogonal Latin Squares of order $n \equiv 2 \pmod 4$. **(Chapter - 6 Sections: 6.1 –6.5)**	10	CO 5

Text Book

1.	*Rodger, C.A. and Charles C. Lindner*, 2009. **Design Theory**, [Second Edition]. CRC Press, New York.

Reference Books

1.	*Ian Anderson*, 1998.**Combinatorial Designs and Tournaments,** Clarendon Press, Oxford.
2.	*Yury J. Lonin and Mohan S, Shrikande*. 2006. **Combinatorics of Symmetric Designs**, Cambridge University Press.
3.	*Wallis, W.D.*, 2007. **Introduction to Combinatorial Designs**, [Second Edition]. Chapman and Hall/CRC, New York.

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COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO 1	Learn the concepts of construction of triple system
CO 2	Design Latin squares for various triple system
CO 3	Understand the concepts of maximum packing and minimum covering
CO 4	Construct pairwise balanced design for Kirkman triple system
CO 5	Gain knowledge on Euler conjecture

MAPPING

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	M	H	M	H	M
CO 2	M	H	M	H	M
CO 3	M	H	M	H	M
CO 4	M	H	M	H	M
CO 5	M	H	M	H	M

H-High; M-Medium; L-Low

K.S. RANGASAMY COLLEGE OF ARTS & SCIENCE (AUTONOMOUS) ★ TIRUCHENGODE-637 215. ★ CONTROLLER OF EXAMINATIONS

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18PMAEL202	ELECTIVE I: STOCHASTIC PROCESS	SEMESTER – II

Course Objectives:

The Course aims

- To give a good grip on concepts in Stochastic Process (Random Process).
- To provide a sound knowledge about rare events occurrence problems.

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs.	CO
I	**Stochastic Processes:** Introduction – Specification of stochastic processes – Stationary processes - Second order process – Stationarity – Gaussian processes. **Markov chains:** Definition and Examples - Transition matrix - Order of Markov Chain – Higher Transition probabilities. **(Chapter - 2 Sections: 2.1, 2.2, 2.3, 2.3.1, 2.3.2, 2.3.3) (Chapter – 3 Sections: 3. 3.1, 3.1.1, 3.1.2, 3.2)**	10	CO 1
II	**Markov Chains:**Classification of states and Chains: Communication Relations – Class property – Classification of chains – Classification of states – Determination of higher transition probabilities – Aperiodic chain. **(Chapter - 3 Sections: 3.4, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5, 3.5.1)**	10	CO 2
III	**Markov Processes with discrete state space:** Poisson process – Introduction – Postulates for Poisson process – Properties of Poisson process – Poisson process and related distributions – Inter arrival time – Pure Birth process – Birth and Death process. **(Chapter - 4 Sections: 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.3.3, 4.4)**	10	CO 3
IV	**Markov Processes with continuous state space**: Introduction - Brownian motion - Wiener Process - Differential equations for a Wiener process - Kolmogorov equations - First passage time distribution for Wiener process – Distribution of maximum of a Wiener process - Distribution of the first passage time to a fixed point.**(Chapter - 5 Sections: 5.1, 5.2, 5.3, 5.4, 5.5, 5.5.1, 5.5.2)**	10	CO 4
V	**Renewal Processes and Theory**: Renewal Process –Renewal process in discrete time – Relation between $F(S)$ and $P(S)$ - Renewal processes in continuous time – Renewal function and Renewal density –Renewal theorems (Statement of Black Well's and Smith's theorems) - Residual and excess lifetimes – Poisson Process as a Renewal Process- Distribution of $Y(t)$ and $Z(t)$ – Moments of the Asymptotic Distributions. **(Chapter – 6 Sections: 6.1, 6.1.1, 6.1.2, 6.2, 6.2.1, 6.5.4, 6.7, 6.7.1, 6.7.2, 6.7.3)**	10	CO 5

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Text Book	
1.	*Medhi, J.* 2006. **Stochastic Processes.** [Second Edition]. New Age International Publications, New Delhi
Reference Books	
1.	*Karlinand Taylor, H.M.* 1975. **First Course in Stochastic Processes. [Volume 1].** Academic Press.
2.	*Bhat, B.R.* 2000, **Stochastic Models: Analysis and Applications.** New Age International Publications, India.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO 1	Learn about Gaussian processes and Markov chain
CO 2	Understand the classification of chains
CO 3	Gain knowledge on Poisson processes and birth-death process
CO 4	Know Kolmogorov and Wiener process
CO 5	Learn the well known theorems on renewal process

MAPPING

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	M	H	M	L	L
CO 2	M	H	M	L	L
CO 3	M	M	M	L	L
CO 4	M	M	M	L	L
CO 5	M	M	M	L	L
H-High; M-Medium; L-Low					

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18PMAEL203	ELECTIVE I: DIFFERENCE EQUATIONS	SEMESTER – II

Course Objectives:

The Course aims

- To provide knowledge for solving difference equations.
- To learn about Stability theory.

Credits: 4

UNIT	CONTENTS	Total Hours: 50 Hrs.	CO
I	**Difference Calculus:** Difference Operator - Summation – Generating Function and Approximate Summation. **(Chapter - 2 Sections: 2.1 – 2.3)**	10	CO 1
II	**Linear Difference Equations:** First order equations - General Results for linear equations - Solving Linear equations **(Chapter - 3 Sections: 3.1 – 3.3)**	10	CO 2
III	**Linear Difference Equations (Contd.):** Equations with variable Coefficients – The z – Transform **(Chapter – 3Sections: 3.5 and 3.7)**	10	CO 3
IV	**Stability Theory:** Initial Value problems for linear systems – Stability of linear systems **(Chapter – 4 Sections: 4.1 and 4.2)**	10	CO 4
V	**Asymptotic Methods:** Introduction – Asymptotic analysis of sums – linear equations **(Chapter - 5 Sections: 5.1 – 5.3)**	10	CO 5

Text Book

1. *Kelly, W.G.andPeterson, A.C.* 1991. **Difference Equations,** [Second Edition]. Academic Press, New York.

Reference Books

1. *Elaydi, S.N.* 1991. **An Introduction to Difference Equations,** Springer–Verlag, New York.
2. *Mickens, R.* 1990. **Difference Equations.** Van Nostrand Reinhold, New York.
3. *Agarwal, R.P.* 1992. **Difference Equations and Inequalities,** Marcel Dekker, New York.

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COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO 1	Describe difference calculus with generating function
CO 2	Discuss general results for linear equations
CO 3	Analyze linear difference equations with variable coefficients
CO 4	Verify stability of linear system
CO 5	Explain asymptotic analysis of linear equations

MAPPING

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	M	M	M	H	M
CO 2	M	H	M	H	M
CO 3	M	M	M	H	M
CO 4	M	H	M	H	M
CO 5	M	H	M	H	M

H-High; M-Medium; L-Low

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K.S. RANGASAMY COLLEGE OF ARTS & SCIENCE (AUTO) CONTROLLER OF EXAMINATIONS TIRUCHENGODE-637 215

18PMAEL301	ELECTIVE II: CONTROL THEORY	SEMESTER – III

Course Objectives:

The Course aims

- To impart analytical skills, in the areas of Initial and Boundary value problem of Control techniques.
- To serves as a prerequisite for specialized studies and research.

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs.	CO
I	**Introduction:**Basic Results of Differential Equations – Fixed Point Methods.**Observability:** Linear Systems – Nonlinear Systems. **(Chapter - 1 Sections: 1.2, 1.3) (Chapter - 2 Sections: 2.1, 2.2)**	10	CO 1
II	**Controllability:** Linear Systems – Nonlinear systems. **(Chapter - 3 Sections: 3.1, 3.2)**	10	CO 2
III	**Stability:** Linear Systems– Perturbed linear systems – Nonlinear systems. **(Chapter - 4 Sections: 4.1 – 4.3)**	10	CO 3
IV	**Stabilizability:** Stabilization via Linear Feedback Control –The Controllable Subspace. **(Chapter - 5 Sections: 5.1, 5.2)**	10	CO 4
V	**Optimal Control:** Linear Time Varying Systems– Linear Time Invariant Systems. **(Chapter - 6 Sections: 6.1, 6.2)**	10	CO 5

Text Book

1.	*Balachandran. KandDauer. J.P. 2012.***Elements of Control Theory.**[Second Edition]. NarosaPublishing House, New Delhi.

Reference Books

1.	*Conti, R.* 1976.**Linear Differential Equations and Control.** Academic Press,London.
2.	*Klamka,* J. 1991.**Controllability of Dynamical Systems.** Kluwer Academic Publisher, Dordrecht.
3.	*Russell, D.L.*1979.**Mathematics of Finite Dimensional Control Systems.**Marcel Dekker, New York.

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COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO 1	Learn about observability of linear and non-linear systems
CO 2	Discuss about controllability Grammian
CO 3	Understand the stability of linear time varying system and perturbed linear systems
CO 4	Stabilize a system via linear feedback control
CO 5	Find optimum control of Riccati equation and linear time invariant systems

MAPPING

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	H	M	M	H	M
CO 2	H	M	M	H	M
CO 3	H	M	M	H	M
CO 4	H	M	M	H	M
CO 5	H	M	M	H	M

H-High; M-Medium; L-Low

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18PMAEL302	ELECTIVE II: NEURAL NETWORKS	SEMESTER – III

Course Objective:

The Course aims

- To develop the skills to gain a basic understanding of neural network

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs.	CO
I	**Neuron Model and Network Architectures:** Neuron Model – Network Architectures. **An Illustrative Example:** Perceptron – Hamming Network – Hopfield Network. **(Chapter –2 and 3)**	10	CO 1
II	**Perceptron Learning Rule:** Learning Rules – Perceptron Architecture – Perceptron Learning Rule – Proof of Convergence. **Supervised Hebbian Learning:** Linear Associator – The Hebb Rule – Performance Analysis - Pseudoinverse Rule – Application – Variations of Hebbian Learning. **(Chapter –4 and 7).**	10	CO 2
III	**Performances Surfaces and Optimum Points:** Taylor Series – Vector Case - Directional Derivatives – Minima – Necessary Conditions for Optimality – First-Order Conditions – Second-Order Conditions - Quadratic Functions. **(Chapter –8).**	10	CO 3
IV	**Performance Optimization:** Steepest Descent – Stable Learning Rates – Minimizing Along a Line - Newton's Method – Conjugate Gradient. **BackPropagation:** Multilayer Perceptrons – Pattern Classification – Function Approximation – Using BackPropagation – Convergence - Generalization. **(Chapter – 9and 11).**	10	CO 4
V	**Associative Learning:** Simple Associative Network – Unsupervised Hebb rule – Hebb Rule with Decay - Simple Recognition Network – Instar Rule – Kohonen Rule - Simple Recall Network – Outstar Rule. **(Chapter –13)**	10	CO 5

Text Book

1. *Martin T. Hagan, Howard B. Demuth and Mark Beale,* 2010. **Neural Network Design,** Cengage Learning India Private Ltd., New Delhi.

Reference Books	
1.	James A. *Freeman and David M. Skapura,* 2003. **Neural Networks Algorithms, applications and Programming Techniques**, Pearson Education.
2.	*Robert J. Schalkoff*,1997. **Artificial Neural Network**,Mcgraw-Hill International Edition.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO 1	Learn basic neural network architecture
CO 2	Gain knowledge on Perceptron learning rule and Hebb rule
CO 3	Know about the optimality conditions for various functions
CO 4	Understand the concepts of performance optimization and Backpropagation
CO 5	Learn the concepts of associative learning

MAPPING

PSO / CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	H	L	M	L	H
CO 2	H	L	L	L	H
CO 3	H	L	M	M	H
CO 4	H	L	M	M	H
CO 5	H	L	L	L	H
H-High; M-Medium; L-Low					

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18PMAEL303	ELECTIVE II: NUMBER THEORY	SEMESTER – III

Course Objectives:

The Course aims

- To enrich the knowledge of students in logical reasoning.
- To give a grip on elementary concepts of number theory
- To provide a sound knowledge about congruence's, Mobius function and Diophantine equations

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs.	CO
I	**Divisibility:** Introduction -Divisibility – Primes. **Congruences:** Congruences – Solutions of Congruences. **(Chapter - 1 Sections: 1.1 - 1.3) (Chapter - 2 Sections: 2.1, 2.2)**	10	CO 1
II	**Congruences:** Prime Power Moduli – Prime Modulus –Primitive Roots and Power Residues - Congruences of Degree Two, Prime Modulus. **(Chapter - 2 Sections: 2.6 – 2.9)**	10	CO 2
III	**Quadratic Reciprocity:** Quadratic Residues – Quadratic Reciprocity – The Jacobi Symbol – Binary Quadratic Forms. **(Chapter - 3 Sections: 3.1 – 3.4)**	10	CO 3
IV	**Some Functions of Number Theory:** Greatest Integer Function - Arithmetic Functions – The Mobius Inversion Formula – Recurrence Functions. **(Chapter 4: Sections 4.1 – 4.4)**	10	CO 4
V	**Some Diophantine Equations:** The Equation ax + by = c – Simultaneous Linear Equations – Pythagorean Triangles – Assorted Examples. **(Chapter 5: Sections 5.1 – 5.4)**	10	CO 5

Text Book

1.	*Ivan Niven, Zuckerman, H.S. and Hugh L. Montgomery, 2014.* **An Introduction to the Theory of Numbers.** [Fifth Edition]. Wiley India Private Ltd., New Delhi.

Reference Books

1.	*Burton, D.M.* 2001. **Elementary Number Theory.** Universal Book Stall, New Delhi.
2.	*Ireland, K.and Rosen, M.* 1972. **A Classical Introduction to Modern Number Theory.** Springer Verlag, New York.
3.	*Apostal, T.M.* 1980. **Introduction to Analytic Number Theory.** Narosa Publication House, Chennai.

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COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO 1	Learn about divisibility and solution of Congruences
CO 2	Discuss Prime modulus, Primitive roots and Power Residuals
CO 3	Understand the concepts of Quadratic residues and Quadratic Reciprocity
CO 4	Gain knowledge on mobius inverse formula and recurrence functions
CO 5	KnowDiaphantine equations and Pythagorean triangles

MAPPING

PSO / CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	M	H	M	H	M
CO 2	M	H	M	H	M
CO 3	M	H	M	H	M
CO 4	M	H	M	H	M
CO 5	M	H	M	H	M
H-High; M-Medium; L-Low					

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