



Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

Accredited by NAAC as 'A++' Grade University ♦ Approved by AICTE ♦ ISO 9001-2015 Certified

Campus: Green Fields, Vaddeswaram - 522 502, Guntur District, Andhra Pradesh, INDIA.

Phone No. 0863 - 2399999; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002 Ph: +91 - 866 -2577715, Fax: +91-866-2577717.

To
The Dean –Academics
K L Deemed University
Vaddeswaram

BOS No.9/2020-21.

Dear Sir,

Sub: Minutes of the BOS Meeting, Department of Mathematics held on 22-05-2021 virtually from 3.00 P.M.-Reg.,

Greetings to you.

Department of Mathematics, K.L.E.F. has conducted BOS meeting on 22-05-2021 virtually from 3.00 P.M. in the following link. Here I am submitting Minutes of meeting for your kind Perusal.

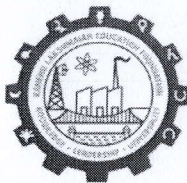
Venue: Virtual class room

<https://kluniversity.webex.com/kluniversity/j.php?MTID=m0d4f0142a158398af57d2b500c9966a2>

Thanking You,

Yours sincerely

Dr B.V.Appa Rao,
Chairman BOS,
Dr. B.V. APPA RAO
Professor & Head Dept. of Mathematics
KLEF, (Deemed to be University)
Green Fields, Vaddeswaram-522 302,
Guntur Dist., A.P., India.



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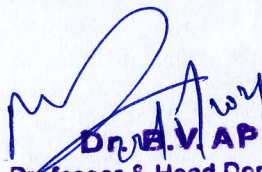
Department of Mathematics

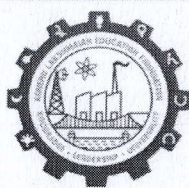
BOS No. 9/2020-21.

Minutes of the BOS meeting, Mathematics Department held on 22-05-2021, virtually from 3.00 P.M.

The following members present in the meeting:

1. Dr.Raghuveer, V.R., Dean- Academics, Internal Member.
2. Dr.B.V.Appa Rao, Chairman-BOS, Professor & H.O.D., Department of Mathematics, K.L.E.F.
3. Dr.Vasudeva Rao, A., Academic Expert, Professor, Department of Mathematics, I.I.T., Bhubaneswar.
4. Dr.Debasish Dutta, Academic Expert, Professor & H.O.D., Department of Mathematics, NIT, Warangal.
5. Dr.S.Suresh Kumar, Industry Expert, Manager, Data Science, Capital One, Bangalore.
6. Dr.B.Nageswara Rao, Subject Expert, Professor, Department of Mathematics, K.L.E.F.
7. Mr.Hari Kiran, V, Subject Expert, Professor & H.O.D., Department of C.S.E., K.L.E.F.
8. Dr.V.Vasanta Kumar, Internal Member, Professor, Department of Mathematics, K.L.E.F.
9. Dr.K.Jayarami Reddy, Internal Member, Professor, Department of Mathematics, K.L.E.F.
10. Dr.Ch.V.Ramanamurthy, Internal Member, Professor, Department of Mathematics, K.L.E.F.
11. Dr.V.S.Bhagavan, Internal Member, Professor, Department of Mathematics, K.L.E.F.
12. Dr.G.V.Ramana Reddy, Internal Member, Professor, Department of Mathematics, K.L.E.F.
13. Dr.N.Srimannarayana, Internal Member, Professor, Department of Mathematics, K.L.E.F.
14. Dr.V.B.V.N.Prasad, Internal Member, Professor, Department of Mathematics, K.L.E.F.
15. Dr.G.Suresh Kumar, Internal Member, Associate Professor, Department of Mathematics, K.L.E.F.
16. Dr.T.Srinivasa Rao, Internal Member, Associate Professor, Department of Mathematics, K.L.E.F.
17. Dr.K.Rajya Lakshmi, Internal Member, Assistant Professor, Department of Mathematics, K.L.E.F.
18. Dr.D.Ramesh, Internal Member, Assistant Professor, Department of Mathematics, K.L.E.F.


DR. B.V. APPA RAO
Professor & Head Dept. of Mathematics
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Dr.B.V.Appa Rao, Chairman of BOS opened the meeting by welcoming and introducing the external members, to the internal and co-opted members and thanked them for accepting to become the member of the Board of Studies.

After due deliberations, the following resolutions have been adopted:

AGENDA ITEMS

1. To revise the P.G. Program-M.Sc. (Applied Mathematics) existing syllabus along with the structure with Electives and without Streams to be admitted students for the Academic Year 2021-2022.
2. As per the Dean (Academics) guidelines to incorporate one of the English Proficiency Courses in the appropriate semester of the program.
3. Resolved to include Two Courses "Design Thinking and Innovation (DTI) – 1 & 2" in Semester-2 and 3 respectively into the Curriculum of Y21 admit batch of M.Sc. (Applied Mathematics) students.
4. To carry out the Department Faculty Collaborative Research Work with the Industry Persons in order to improve the R&D activity.
5. To establish MOU's between the Department Faculty and the other University Faculty to carry out collaborative projects/research work.

AGENDA and RESOLUTIONS

AGENDA ITEM-1

To revise the P.G. Program-M.Sc. (Applied Mathematics) existing syllabus along with the structure by introducing new Elective courses for 2021-22 admitted batch students.

Approved and recommended to Academic Council for approval

- It was resolved to modify L-T-P-S structure for Y21 Batch Curriculum. BOS members recommended and forwarded to Academic Council for approval.
- Dr.V.S.Bhagavan, Professor and Dr.Ch.V.Ramanamurthy, Professor recommend to reduce the Credits from 4 to 3 for some courses. Dr. Vasudeva Rao Allu, Associate Professor, Department of Mathematics, IIT, Bhubaneswar, recommended Tutorials in the L-T-P-S structure from 4-0-0-0 to 3-1-0-0 for some courses. BOS members recommended and forwarded to Academic Council for approval.
- Dr.Debashish Dutta, Professor & HOD, NIT, Warangal, proposed the Syllabus with Electives and without Streams. And it was resolved to change the Curriculum and Syllabus with three Electives, one in Semester 3 and two in Semester 4 with each elective consist of three courses. Total number of credits in the syllabus is 94. BOS members recommended and forwarded to Academic

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Council for approval.

The following Elective courses suggested for M.Sc. (Applied Mathematics) from the A.Y.: 2021-22 :

S.No.	Course Code	Course Title	Category	Year of Study
1	21AM2106	Operations Research	PE	II
2	21AM2107	Functional Analysis	PE	II
3	21AM2108	Fuzzy mathematics and applications	PE	II
4	21AM2204	Mathematical Modelling	PE	II
5	21AM2205	Mathematical Control Theory		
6	21AM2206	Dynamical Systems	PE	II
7	21AM2207	Advanced Numerical Analysis	PE	II
8	21AM2208	Number Theory	PE	II
9	21AM2209	Applied Stochastic Processes	PE	II

- Mr. Suresh Kumar Simhadri, Manager, Data Science, Capital One, Bangalore, proposed to introduce any course of mathematics or statistics with MATLAB or Python or R-Programming for analysis of data in industries as per the contemporary needs in industries.
- Mr. Suresh Kumar Simhadri, Manager, Data Science, Capital One, Bangalore, recommended MATLAB skill course as per the present needs for industries. The Technical Skills (21AM1206) course suggested for M.Sc. (Applied Mathematics) from the A.Y.: 2021-22. BOS members recommended and forwarded to Academic Council for approval.

(Annexure: 1 : Y21_Structure

Annexure: 2 : Y21_Curriculum)

(Annexure: 3 : Syllabus)

AGENDA ITEM-2

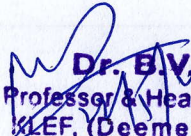
As per the Dean (Academics) guidelines to incorporate one of the English Proficiency Courses in the appropriate semester of the program.	Approved and recommended to Academic Council for approval
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- It was resolved to introduce English Proficiency Course in the M.Sc. (Applied Mathematics) program. BOS members recommended and forwarded to Academic Council for approval.

(Annexure:1 : Y21_Structure)

(Annexure:2 : Y21_Curriculum)

(Annexure:3 : Syllabus)


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AGENDA ITEM-3

Resolved to include Two Courses "Design Thinking and Innovation (DTI) – 1 & 2" in Semester-2 and 3 respectively into the Curriculum of Y21 admit batch of M.Sc. (Applied Mathematics) students.	Approved and recommended to Academic Council for approval
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- Mr. Suresh Kumar Simhadri, Manager, Data Science, Capital One, Bangalore,, suggested to give more focus on design & implementation. And it was resolved to introduce "**Design Thinking and Innovation – 1**" course into M.Sc.(Applied Mathematics) in 3rd Semester through online mode and "**Design Thinking and Innovation – 2**" course through online mode in 4th Semester curriculum. BOS members recommended and forwarded to Academic Council for approval.

(Annexure: 1 : Y21_Structure

Annexure: 2 : Y21_Curriculum)

AGENDA ITEM-4

To carry out the Department Faculty Collaborative Research Work with the Industry Persons in order to improve the R&D activity.	Approved and recommended to Academic Council for approval
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- It was resolved to do Collaborative research work. BOS members recommended and forwarded to Academic Council for approval.

AGENDA ITEM-5

To establish MOU's between the Department Faculty and the other University Faculty to carry out collaborative projects/research work.	Approved and recommended to Academic Council for approval
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- It was resolved to approve MoU's in the department. BOS members recommended and forwarded to Academic Council for approval.


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S.No.	Name & Designation	Address	Position in BOS
1	Dr. Raghuveer VR Dean- Academics	KLEF	BOS Patron VR Raghuveer 25/5/24
2	Dr B V Appa Rao Professor & HOD	KLEF	Chairman B.V. Appa Rao 25/5/24
3	Dr. Vasudeva Rao Allu Associate Professor	Department of Mathematics, Indian Institute of Technology , Bhubaneswar avrao@iitbbs.ac.in, alluvasudevarao@gmail.com Mobile No: 9564165479	External Member Subject Expert A. Vasudeva Rao 25/5/24
4	Dr. Debasish Dutta Professor & HOD	Department of Mathematics, NIT, Warangal Email: ddutta@nitw.ac.in Mobile NO : 9849548445	External Member Subject Expert D. Dutta 25/5/24
5	Mr. Suresh Kumar Simhadri Manager Data Science	Capital One, Bangalore Email: suresh.simhadri@capitalone.com Mobile No: 9513328221	External Member Industry/R&D S. Suresh Kumar 24/5/24
6	Dr B Nageswara Rao Professor of ME (Former Scientist - ISRO)	KLEF	Subject Expert B. Nageswara Rao 25/05/2024
7	Mr Hari Kiran V HOD -CSE	KLEF	Member V. Hari Kiran 25/06/2019
8	Dr V Vasanta Kumar Professor	KLEF	Internal Member V. Vasanta Kumar 24/5/24
9	Dr K. Jayarami Reddy Professor in lien (CEO, AP Science city), Tadepalli, AP	KLEF	Member K. Jayarami Reddy 25/5/24
10	Dr V S Bhagavan Professor	KLEF	Secretary V. S. Bhagavan 25/05/2024
11	Dr G V Ramana Reddy Professor	KLEF	Internal Member G. V. Ramana Reddy 25/5/24
12	Dr N Srimannarayana Professor	KLEF	Internal Member N. S. Srimannarayana 22/5/24
13	Dr Ch V RamanaMurthy Professor	KLEF	Internal Member Ch. V. RamanaMurthy 22/05/24
14	Dr V B V N Prasad Professor	KLEF	Internal Member V. B. V. N. Prasad 22/05/24
15	Dr G Suresh Kumar Associate Professor	KLEF	Internal Member G. Suresh Kumar 22/5/24
16	Dr T.Srinivasa Rao Associate Professor	KLEF	Internal Member T. S. Srinivasa Rao 22/5/24
17	Dr D. Ramesh Assistant professor	KLEF	Internal Member D. Ramesh 22/5/2024
18	Dr K Rajya Lakshmi Assistant Professor	KLEF	Internal Member K. Rajya Lakshmi 22/5/24

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Annexure:1

(Y21_Course Structure)

Department of Mathematics
M.Sc.(Applied Mathematics)
Y21_Course Structure(2021-22)

SNO	COURSE CODE	COURSE NAME	Type	L	T	P	S	CH	CR	Pre requisites
I Year I Sem.										
1	21AM1101	Real Analysis	PC	4	0	0	0	4	4	NIL
2	21AM1102	Ordinary Differential Equations	PC	3	0	2	0	3	4	NIL
3	21AM1103	Discrete Mathematics	PC	3	1	0	0	4	4	NIL
4	21AM1104	Introduction to Computer Programming	PC	3	0	2	0	5	4	NIL
5	21AM1105	Mathematical Statistics	PC	3	1	0	0	4	4	NIL
6	21AM1106	Seminar-1	PC	0	0	2	0	1	1	NIL
7	20UC1101	Integrated Professional English	HSS	0	0	4	0	4	2	NIL
Total				16	2	10	0	25	23	
I Year II Sem.										
1	21AM1201	Abstract Algebra	PC	3	0	0	0	3	3	NIL
2	21AM1202	Data Structures	PC	3	0	2	0	5	4	NIL
3	21AM1203	Statistical Inference	PC	3	1	0	0	4	4	NIL
4	21AM1204	Numerical Analysis	PC	3	0	2	0	5	4	NIL
5	21AM1205	Complex Analysis	PC	3	1	0	0	4	4	NIL
6	21AM1206	Technical Skills	Skill	0	0	0	4	4	1	NIL
7	21AM1207	Seminar-2	PC	0	0	2	0	2	1	NIL
8	20UC1102	Design Thinking and Innovation - 1	HSS	1	0	0	4	5	2	NIL
Total				16	2	6	8	32	23	
II Year I Sem.										
1	21AM2101	Topology	PC	3	0	0	0	3	3	NIL
2	21AM2102	Partial Differential Equations	PC	3	1	0	0	4	4	NIL
3	21AM2103	Continuum Mechanics	PC	3	1	0	0	4	4	NIL
4	21AM2104	Statistics with R Programming	PC	3	0	2	0	5	4	NIL
5	21AM2105	Seminar-3	PC	0	0	2	0	2	1	NIL
6		Elective-I		3	1	0	0	4	4	NIL
7	20UC1102	Design Thinking and Innovation - 2	HSS	1	0	0	4	5	2	NIL
Total				16	3	4	4	26	22	
II Year II Sem.										

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1	21AM2201	Fluid Dynamics	PC	3	0	2	0	5	4	NIL
2	21AM2202	Transform Techniques	PC	3	0	2	0	5	4	NIL
3	21AM2203	Dissertation with Research Publication	PC	0	0	24	0	24	12	NIL
4		Elective-II		3	1	0	0	4	4	NIL
5		Elective-III		3	1	0	0	4	4	NIL
		Total		12	2	28	0	42	28	
		Elective-I								
1	21AM2106	Operations Research	PE	3	1	0	0	4	4	NIL
2	21AM2107	Functional Analysis	PE	3	1	0	0	4	4	NIL
3	21AM2108	Fuzzy mathematics and applications	PE	3	1	0	0	4	4	NIL
		Elective-II								
1	21AM2204	Mathematical Modelling	PE	3	1	0	0	4	4	NIL
2	21AM2205	Mathematical Control Theory	PE	3	1	0	0	4	4	NIL
3	21AM2206	Dynamical Systems	PE	3	1	0	0	4	4	NIL
		Elective-III								
1	21AM2207	Advanced Numerical Analysis	PE	3	0	2	0	5	4	NIL
2	21AM2208	Number Theory	PE	3	1	0	0	4	4	NIL
3	21AM2209	Applied Stochastic Processes	PE	3	1	0	0	4	4	NIL


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Annexure:2

(Y21_Curriculum)

Program Structure :

SNO	COURSE CODE	COURSE NAME	Type	L	T	P	S	CH	CR	Pre requisites	New Course/Revised/Retained Course	Changes Proposed By	Focused on Employability/Entrepreneurship/
1	21AM1101	Real Analysis	PC	4	0	0	0	4	4	NIL	Retained Course		Employability
2	21AM1102	Ordinary Differential Equations	PC	3	0	2	0	3	4	NIL	Retained Course		Employability
3	21AM1103	Discrete Mathematics	PC	3	1	0	0	4	4	NIL	Retained Course		Employability
4	21AM1104	Introduction to Computer Programming	PC	3	0	2	0	5	4	NIL	Retained Course		Employability
5	21AM1105	Mathematical Statistics	PC	3	1	0	0	4	4	NIL	Retained Course		Employability

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6	21AM1106	Seminar-1	PC	0	0	2	0	1	1	NIL	Retained Course		Employability
7	20UC1101	Integrated Professional English	HSS	0	0	4	0	4	2	NIL	Retained Course	Academic Peers	Employability
8	21AM1201	Abstract Algebra	PC	3	0	0	0	3	3	NIL	Retained Course		Employability
9	21AM1202	Data Structures	PC	3	0	2	0	5	4	NIL	Retained Course		Employability
10	21AM1203	Statistical Inference	PC	3	1	0	0	4	4	NIL	Retained Course		Employability
11	21AM1204	Numerical Analysis	PC	3	0	2	0	5	4	NIL	Retained Course		Employability
12	21AM1205	Complex Analysis	PC	3	1	0	0	4	4	NIL	Retained Course		Employability


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13	21AM1205	Technical Skills	PC	0	0	0	0	4	4	1	NIL	New Course	Academic Peers, Industry persons	Employability
14	21AM1207	Seminar-2	PC	0	0	2	0	2	2	1	NIL	Retained Course		Employability
15	20UC1202	Design Thinking and Innovation -1	HSS	0	0	0	4	4	2		NIL	New Course	Industry Persons	Employability
	20UC1202	Design Thinking and Innovation -2	HSS	0	0	0	4	4	2		NIL	New Course	Industry Persons	Entrepreneurship/Skill
16	21AM2101	Topology	PC	3	0	0	0	3	3		NIL	Retained Course		Employability
17	21AM2102	Partial Differential Equations	PC	3	1	0	0	4	4		NIL	Retained Course		Employability
18	21AM2103	Continuum Mechanics	PC	3	1	0	0	4	4		NIL	Retained Course		Employability

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19	21AM2104	Statistics with R Programming	PC	3	0	2	0	5	4	NIL	Retained Course	Employability
20	21AM2105	Seminar-3	PC	0	0	2	0	2	1	NIL	Retained Course	Employability
21	21AM2201	Fluid Dynamics	PC	3	0	2	0	5	4	NIL	Retained Course	Employability
22	21AM2202	Transform Techniques	PC	3	0	2	0	5	4	NIL	Retained Course	Employability
23	21AM2203	Dissertation with Research Publication	PC	0	0	24	0	24	12	NIL	Retained Course	Employability
		Elective-I										
24	21AM2106	Operations Research	PE	3	1	0	0	4	4	NIL	Retained Course	Employability


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25	21AM21C7	Functional Analysis	PE	3	1	0	0	4	4	NIL	New Course	Academic Peers	Employability
26	21AM21C8	Fuzzy mathematics and applications	PE	3	1	0	0	4	4	NIL	New Course	Academic Peers	Employability
		Elective-II										Academic Peers	
27	21AM22C4	Mathematical Modelling	PE	3	1	0	0	4	4	NIL	New Course	Academic Peers	Employability
28	21AM22C5	Mathematical Control Theory	PE	3	1	0	0	4	4	NIL	New Course	Academic Peers	Employability
29	21AM22C6	Dynamical Systems	PE	3	1	0	0	4	4	NIL	New Course	Academic Peers	Employability
		Elective-III											
30	21AM22C7	Advanced Numerical Analysis	PE	3	0	2	0	5	4	NIL	New Course	Academic Peers	Employability

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31	21AM2203	Number Theory	PE	3	1	0	0	4	4	NIL	New Course	Academic Peers	Employability
32	21AM2209	Applied Stochastic Processes	PE	3	1	0	0	4	4	NIL	New Course	Academic Peers	Employability

Percentage of Syllabus Revision = $9/32 = 3.125\%$

Percentage of Courses focusing on Employability = $30/32 = 93.75\%$

Percentage of Courses focusing on Entrepreneurship = $2/32 = 6.25\%$

Percentage of Courses focusing on Skill Development = $3/32 = 9.375\%$



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Annexure:3 (Syllabus)

21AM2107- Functional Analysis

L-T-P-S: 3-1-0-0

Credits: 4

Prerequisite: NIL

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Illustrate basic concepts of metric spaces, results on inequalities, spaces of sequences and functions.	PO2	3
CO2	Demonstrate bounded linear operators over normed and Hilbert spaces	PO2	3
CO3	Illustrate the results on various operators on Banach and Hilbert Spaces.	PO2	3
CO4	Apply fixed point results to solve integral equations	PO2	3

Syllabus

Fundamentals of metric spaces, Completion metric spaces, normed spaces, Hölder inequality, Minkowski inequality and vector spaces with examples of ℓ_p and L_p spaces. Normed linear spaces, Banach spaces with examples, Convergence and absolute convergence of series in a normed linear space. Inner product spaces, Hilbert spaces, Relation between Banach and Hilbert spaces. Schwarz inequality. Convex sets, Existence and uniqueness of a vector of minimum length, Projection theorem. Orthogonal and orthonormal systems in Hilbert space with examples, Bessel's inequality, Parseval's identity, Characterization of complete orthonormal systems. Continuity of linear maps on normed linear spaces, Four equivalent norms on $B(N, N')$, Conjugate and Dual spaces, The Riesz Representation Theorem. Adjoint operators, self adjoint operators, normal operators, Unitary operators on Hilbert spaces (H) and their properties. Isometric isomorphism of H onto itself under Unitary operators and their importance. Projection operators on Banach spaces and Hilbert spaces. Orthogonal Projections. Contraction Mappings with examples, Banach-fixed point theorems and applications. The Closed Graph Theorem, The Uniform Boundedness Principle and its applications, The Hahn – Banach Extension and Separation Theorems, Open mapping Theorem and applications.

Suggested books:

1. Simons, G. F., "Introduction to Topology and Modern Analysis", McGraw Hill.
2. Debnath L. K. and Mikusinski P., "Introduction to Hilbert Spaces with Applications", Academic Press.
3. Bachman G. and Narici L., "Functional Analysis", Academic Press.
4. Ponnusamy S., "Foundation of Functional Analysis", Narosa Publication.
5. Jain P. K. and Ahuja O. P., "Functional Analysis", New Age International Publishers.
6. Nair, M. T., "Functional Analysis: A First Course", PHI Pvt. Ltd.

21AM2108-Fuzzy mathematics and applications

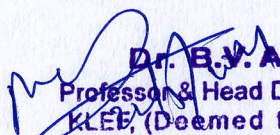
L-T-P-S: 3-1-0-0

Credits: 4

Prerequisite: NIL

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No:	Course out come	PO/PSO	DTL
1	Describe the relationship between the crisp sets and fuzzy sets.	PO4	2
2	Demonstrate fuzzy operations and relations on fuzzy sets.	PO6	3
3	Illustrate fuzzy logic, switching functions and circuits.	PO6	3


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4	Apply fuzzy sets and fuzzy logic in control systems.	PO1	3
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Syllabus

CRISP SET THEORY: Introduction; Relations between Sets; Operations on Sets; Characteristic Functions; Cartesian product of Crisp Sets; Crisp Relations on Sets. **FUZZY SET THEORY:** Introduction; Concept on a Fuzzy Set; Relations between Fuzzy Sets; Operations of Fuzzy Sets; Properties of the Standard Operations; Certain numbers Associated with a Fuzzy Set; Certain Crisp Sets Associated with a Fuzzy Set; Certain Fuzzy Sets Associated with a Given Fuzzy Set; Extension Principle. **FUZZY RELATIONS:** Introduction; Fuzzy Relations; Operations on Fuzzy Relations; α -Cuts of a Fuzzy Relation; Composition of Fuzzy Relations; Projections of Fuzzy Relations; Cylindrical Extensions; Cylindrical Closure; Fuzzy Relation on a Domain. **FUZZY LOGIC:** Introduction; Three-valued Logics; N -valued Logics $N \geq 4$; Infinite-valued Logics; Fuzzy Logics; Fuzzy Propositions and Their Interpretations in Terms of Fuzzy Sets; Fuzzy Rules and Their Interpretations in Terms of Fuzzy Relations. **SWITCHING FUNCTIONS AND SWITCHING CIRCUITS:** Introduction; Switching Functions; Disjunctive Normal Form; Relation between Switching Functions and Switching Circuits; Equivalence of Circuits; simplification of Circuits. **APPLICATIONS FUZZY METHODS IN CONTROL THEORY:** Introduction; Introduction to Fuzzy Logic Controller; Fuzzy Expert Systems; Classical Control Theory vs. Fuzzy Control; Illustrative Examples; Working of an FLC through Examples; Details of the Components of FLC; Mathematical Formulation of an FLC; Real-life Examples.

Suggested books:

1. M. Ganesh, Introduction to Fuzzy Sets and Fuzzy Logic, PHI.
2. G. J. Klir and B. Yuan, Fuzzy Sets and Fuzzy Logic theory and applications, PHI.
3. T.J. Ross, Fuzzy Logic with engineering Applications, McGraw-Hill Inc.
4. H.J. Zimmerman, Fuzzy sets, Decision making and expert systems, Kluwer, Boston.

21AM2204 - Mathematical Modelling

L-T-P-S: 3-1-0-0

Credits: 4

Prerequisite: NIL

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No:	Course out come	PO	BTL
1	Model and solve real life problems through difference equations	PO1	3
2	Determine the best fitting linear and nonlinear models.	PO1	3
3	Interpret real life problems using simulation modelling.	PO1	3
4	Apply mathematical modelling through differential equations.	PO1	3

SYLLABUS :

Modelling Change, Proportionality, and Geometric Similarity: Modelling Change with Difference Equations, A Savings Certificate, Mortgaging a Home, Approximating Change with Difference Equations, Solutions to Dynamical Systems. Mathematical Models, Modelling Using Proportionality, Modelling Using Geometric Similarity. **Model Fitting:** Fitting Models to Data Graphically, Analytic Methods of Model Fitting, Applying the Least-Squares Criterion, Choosing a Best Model, Vehicular Stopping Distance, Comparing the Criterion. Determining a Production Schedule. **Simulation Modelling:** Simulating Deterministic Behaviour, Area under a

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Curve, Generating Random Numbers, Simulating Probabilistic Behaviour, Inventory Models. **Modelling with Differential Equation:** Population Growth, Graphical Solutions of Autonomous Differential Equations, Drawing a Phase Line and Sketching Solution Curves, Logistic Growth, Numerical Approximation Methods, Using Euler's Method, A Savings Certificate Revisited, Separation of Variables, Newton's Law of Cooling, Population Growth with Limited Resources, Graphical Solutions of Autonomous Systems of First-Order Differential Equations, A Competitive Hunter Model, A Predator--Prey Model.

Textbooks:

1. Giordano, F. R., Fox W. P., and Horton S. B. (2014), A first course in mathematical modeling, Brooks/Cole.
2. Mesterton-Gibbons, M. (1988). A concrete approach to mathematical modeling. Addison-Wesley.

Reference Books:

3. Kapur J. N., "Mathematical Modelling", New Age International Publishers, 2007.
4. Banerjee Sandip, "Mathematical Modelling Models, Analysis and Applications", CRC Press, Taylor & Francis Group, 2014.

WEB REFERENCES/MOOCs:

1. <https://nptel.ac.in/courses/111/107/111107113/>
2. <https://www.youtube.com/watch?v=ORTNjFdSbzY>
3. <https://www.coursera.org/learn/ordinary-differential-equations>
4. <https://www.edx.org/course/mathematical-modelling-basics>
<https://www.mooc-list.com/course/big-data-mathematical-modelling-futurelearn>

21AM2205-Mathematical control theory

L-T-P-S: 3-1-0-0

Credits: 4

Prerequisite: NIL

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No:	Course out come	PO/PSO	BTL
1	Develop conditions for the controllability and observability of the linear control systems and validate with suitable example.	PO1	3
2	Obtain conditions for the controllability and observability for the nonlinear control systems and illustrate with suitable example.	PO1	3
3	Determine the stability for the linear and nonlinear control systems.	PO1	3
4	Solve the optimal control problems for linear and nonlinear control systems.	PO1	3

Syllabus :

Introduction Problems of mathematical control theory, Specific models. **Controllability and observability for linear systems** linear differential equations, the controllability matrix, Rank condition, Kalman decomposition and Observability. **Controllability and observability for non-Linear systems** Nonlinear differential equations, Controllability and linearization, Lie brackets, The openness of attainable sets and Observability. **Stability of**

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Linear systems Stable linear systems, Stable polynomials. The Routh theorem, Stability, observability, and Liapunov equation, Stabilizability and controllability. **Stability of non-Linear systems** The main stability test, Linearization, The Liapunov function method, LaSalle's theorem Necessary conditions for stabilizability. **Optimal controllability** Bellman's equation and the value function. The linear regulator and stabilization, Impulse control problems, an optimal stopping problem. Iterations of convex mappings.

Suggested books:

1. Jerzy Zabczyk, Mathematical Control Theory: An Introduction, Birkhauser, Boston, Springer.
2. S.Barnett, R.G. Cameron, Introduction to mathematical control theory, Clarendon Press.
3. E.D.Sontag, Mathematical control theory: Deterministic finite dimensional systems, Springer.
4. John B. Baillieul, J.C. Willems, Mathematical control theory, Springer

21AM2206-Dynamical Systems

L-T-P-S: 3-1-0-0

Credits: 4

Prerequisite: NIL

CO No:	Course out come	PO/PSO	BTL
1	Describe Periodic points, graphs, stability and bifurcation.	PO6	2
2	Illustrate itineraries, transition graphs, cantor sets and their applications.	PO6	3
3	Demonstrate invariant sets, Chaotic Attractors, Lyapunov Exponents and their applications.	PO6	3
4	Apply periodic points of higher dimensional maps to dynamical systems.	PO6	3

Mapping of Course outcomes (CO) with program outcomes (PO):

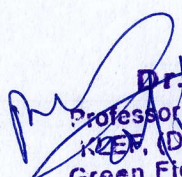
Syllabus:

Iteration of functions as dynamics: One dimensional maps. Functions with several variables Periodic **points of one dimensional maps:** Periodic points, Iteration using the graph, Stability of periodic points, Critical points and Basins, Bifurcation of periodic points. **Itineraries for one-dimensional maps:** Periodic points from transition Graphs, Topological Transitivity, Cantor sets, Piecewise expanding maps and sub shifts, Applications

Invariant sets for one dimensional maps: Limit sets, Chaotic Attractors, Lyapunov Exponents Invariant measures, Applications. **Periodic points of Higher Dimensional maps:** Dynamics of Linear maps, classification of periodic points, stable manifolds, Hyperbolic Toralautomorphisms, Applications.

Suggested books:

1. R. Clark Robinson, An Introduction to Dynamical Systems- continuous and discrete, Second Edition, AMS
2. Anatole Katok, Introduction to Modern theory of Dynamical systems, Cambridge University press.
3. Boris Hasselblatt, Anatole Katok, First Course in Dynamics: with a Panorama of Recent Developments, Cambridge University press.


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21AM2207- Advanced Numerical Analysis

L-T-P-S: 3-0-2-0

Credits: 4

Prerequisite: NIL

Mapping of Course outcomes (CO) with program outcomes (PO):

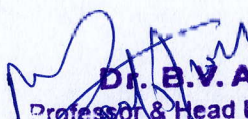
CO No:	Course out come	PO/PSO	BTL
1	Determine the Eigen values of a matrix by various techniques.	PO4	3
2	Apply finite difference method to solve initial value problems.	PO4	3
3	Obtain the solutions of second order PDE.	PO4	3
4	Apply Galerkins, Rayleigh-Ritz methods and their compatibility.	PO4	3
5	Verify the solutions of PDE through MATLAB	PO3	3

Syllabus :

Computations of Eigen Values of a Matrix: Power method for dominant, sub-dominant and smallest Eigen-values, Method of inflation, Jacobi, Givens and Householder methods for symmetric matrices, LR and QR methods. **Initial Value Problems:** Multistep methods, their error analysis and stability analysis. **Finite Difference method:** Review of finite difference operators, finite difference methods. **Elliptic PDE:** Five point formulae for Laplacian, replacement for Dirichlet and Neumann's boundary conditions, curved boundaries, solution on a rectangular domain, block tri-diagonal form and its solution using method of Hackney, condition of convergence. **Parabolic PDE:** Concept of compatibility, convergence and stability, Explicit, full implicit, Crank-Nicholson, du-Fort and Frankel scheme, ADI methods to solve two-dimensional equations with error analysis. **Hyperbolic PDE:** Solution of hyperbolic equations using FD, and Method of characteristics Limitations and Error analysis. **Weighted residual methods:** Collocation, least squares, Galerkins, Rayleigh-Ritz methods and their compatibility.

Suggested books:

1. Gerald, C. F. and Wheatly P. O., "Applied Numerical Analysis", 6th Ed., Addison-Wesley Publishing
2. Smith, G. D., "Numerical Solution of Partial Differential Equations", Oxford University Press.
3. Jain, M. K., "Numerical Solution of Differential Equations", John Wiley.
4. Fausett, L. V., "Applied Numerical Analysis", Prentice Hall, 2nd Ed.
5. Froberg, C. E., "Introduction to Numerical Analysis", 2nd Ed., Addison Wesley.


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21AM2208-Number Theory**L-T-P-S: 3-1-0-0****Credits: 4****Prerequisite: NIL****Mapping of Course outcomes (CO) with program outcomes (PO):**

CO No:	Course out come	PO/PSO	BTL
1	Describe various fundamental results of number theory	PO6	2
2	Demonstrate Residue systems and Quadratic residues.	PO6	3
3	Illustrate Mobius function, finite and infinite continued fractions.	PO6	3
4	Demonstrate the concepts of cryptography, public key cryptography, RSA and their applications.	PO1	3

Syllabus :

Divisibility, Euclidean algorithm, Linear Diophantine equations, Prime numbers, Fundamental theorem of arithmetic, Prime number theorem (statement only). Congruence's, solutions of linear congruence's, Chinese Remainder Theorem, Euler's totient function, Euler-Fermat theorem, Wilson's theorem, non-linear congruence's, Hensel's lemma, primitive roots and power residues. Polynomial congruence's. Reduced residue systems. Quadratic residues, quadratic reciprocity, and the Jacobi symbols. The greatest integer function, Arithmetic functions, Mobius function and Mobius inversion formula. Finite continued fractions, infinite continued fractions, approximation to irrational numbers. Introduction to cryptography, public key cryptography, RSA.

Suggested books:

1. Niven I., Zuckerman H. S., and Montgomery H. L., "An Introduction to the Theory of Numbers", John Wiley & Sons (5th Ed.)
2. Hardy, G., H. and Wright, E. M, "An Introduction to the Theory of Numbers ", Oxford University Press (6th Ed.)
3. Burton D., M., "Elementary Number Theory", McGraw Hill (7th Ed.)
4. Andrews G. E., "Number Theory", Dover Publications
5. Koblitz N., A Course in Number Theory and Cryptography, Springer (2nd Ed.).

21AM2209-Applied Stochastic Processes**L-T-P-S: 3-1-0-0****Credits: 4****Prerequisite: NIL****Mapping of Course outcomes (CO) with program outcomes (PO):**

CO No:	Course out come	PO	BTL
1	Describe the concept of Markov process and Discrete time Markov models.	PO6	2
2	Demonstrate Poisson Process and continuous Markov models.	PO6	3
3	Illustrate generalized Markov models and Queueing models.	PO6	3
4	Demonstrate the concepts of Brownian motions and applications	PO1	3

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Syllabus:

Discrete-Time Markov Models: Discrete-Time Markov Chains, Transient Distributions, Occupancy Times, Limiting Behaviour, First-Passage Times. **Poisson Processes:** Poisson Processes, Superposition of Poisson Processes, Thinning of a Poisson Process, Compound Poisson Processes. **Continuous-Time Markov Models:** Continuous-Time Markov Chains, Transient Analysis: Uniformization, Occupancy Times, Limiting Behaviour, And First-Passage Times. **Generalized Markov Models:** Renewal Processes, Cumulative Processes, and Semi-Markov Processes. **Queueing Models:** Queueing Systems, Single-Station Queues, Birth and Death Queues. **Brownian Motion:** Standard Brownian Motion, Brownian Motion, First-Passage Times, Martingales and Semi martingales, Black Scholes Formula.

Suggested books:

1. V. G. Kulkarni, Introduction to modeling and analysis of stochastic systems, second edition, Springer.
2. S. M. Ross, Stochastic processes, second edition, Wiley.
3. S. Karlin and H. M. Taylor, A first course in stochastic processes, second edition, Academic Press.
4. S. M. Ross, Introduction to Probability Models, tenth edition, Academic Press.

21AM1206-Technical Skill

L-T-P-S: 3-1-0-0

Credits: 4

Prerequisite: NIL

Syllabus :

Calculus, linear algebra, algebraic and ordinary differential equations, equation simplification, and equation manipulation using symbolic computation. Probability Distribution: Fit continuous and discrete distributions, use statistical plots to evaluate goodness-of-fit, compute probability density functions and cumulative distribution functions, and generate random and quasi-random numbers from probability distributions. Functions for fitting curves and surfaces to data. Exploratory data analysis, pre-process and post-process data, compare candidate models, and remove outliers. Regression analysis using the linear and nonlinear models. Non parametric modelling techniques, such as splines, interpolation, and smoothing. Functions for finding parameters that minimize or maximize objectives while satisfying constraints. Linear programming (LP), mixed-integer linear programming (MILP), quadratic programming (QP), nonlinear programming (NLP), constrained linear least squares, nonlinear least squares, and nonlinear equations.

Text books:

1. P. Mohana Shankar, Differential Equations: A Problem Solving Approach Based on MATLAB, CRC Press; 1 edition (23 May 2018).
2. Cesar Perez Lopez, MATLAB Optimization Techniques, Apress Academic, Springer, 2014.

Reference Books:

1. Xue, Dingyu and YangQuan Chen, Solving Applied Mathematical Problems with MATLAB, CRC Press, Taylor & Frances, Boca Raton, 2009.
2. Nikolaos Ploskas and Nikolaos Samaras, Linear Programming Using MATLAB, 1 edition 2017, Springer.
3. Braselton J. Curve Fitting with MATLAB, LINEAR and NON LINEAR REGRESSION, INTERPOLATION, CreateSpace Independent Publishing Platform, 2016, USA.

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Action Taken Report : A.Y. : 2020-21

S.No	Recommendations	Action taken	Name of the Programme	Department
1. Students				
1	No specific recommendations on curriculum.		M.Sc.(Applied Mathematics)	Mathematics
2. Parents				
1	No specific recommendations on curriculum.		M.Sc.(Applied Mathematics)	Mathematics
3. Alumni				
1	No specific recommendations on curriculum.		M.Sc.(Applied Mathematics)	Mathematics
4. Faculty				
1	Dr.V.S.Bhagavan, Professor and Dr.Ch.V.Ramanamurthy, recommend to reduce the Credits from 4 to 3 for some courses.	As per their suggestions, for the courses Abstract Algebra (21AM1201) and Topology (21AM2101) credits has been changed to '3' and forwarded it to Academic Council for approval.	M.Sc.(Applied Mathematics)	Mathematics
5. Academic Peers				
1	Dr. Vasudeva Rao Allu, Associate Professor, Department of Mathematics, IIT, Bhubaneswar, recommended Tutorials in the L-T-P-S structure from 4-0-0-0 to 3-1-0-0 for some courses.	As per his suggestions, the L-T-P-S structure modified for some courses and forwarded to Academic Council for approval.	M.Sc.(Applied Mathematics)	Mathematics
2	Dr. Debasish Dutta, Professor & HOD, NIT, Warangal, proposed the Syllabus with Electives and without Streams.	As per suggestions, Curriculum and Syllabus with three Electives, one in Semester 3 and two in Semester 4 with each elective consist of three courses introduced and forwarded to Academic Council for approval.	M.Sc.(Applied Mathematics)	Mathematics


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3	Proposed the MoU's with other University faculty to improve the R&D activities in the department.	Approved MoU's in the department.	M.Sc.(Applied Mathematics)	Mathematics
6. Industry				
1	Mr. Suresh Kumar Simhadri, Manager, Data Science, Capital One, Bangalore, suggested to give more focus on design & implementation.	As per his suggestions a. Two courses titled Design Thinking & Innovation -1, Design Thinking & Innovation -2 are added to the curriculum for 2019-20 & 2020-21 batch students. b. Design Thinking and Innovation Lab is established in Curriculum and forwarded it to Academic Council for approval.	M.Sc.(Applied Mathematics)	Mathematics
2	Mr. Suresh Kumar Simhadri, Manager, Data Science, Capital One, Bangalore, Proposed to introduce any course of mathematics or statistics with MATLAB or Python or R-Programming for analysis of data in industries as per the contemporary needs in industries.	As per the suggestions, some courses with MATLAB and R-Programming introduced in M.Sc.(Applied Mathematics) from Y21 Curriculum and forwarded to Academic Council for approval.	M.Sc.(Applied Mathematics)	Mathematics
3	Mr. Suresh Kumar Simhadri, Manager, Data Science, Capital One, Bangalore,, recommended MATLAB skill course as per the present needs for industries.	As per his suggestions, Introduced Technical Skill Course with MATLAB in Y21 curriculum and forwarded to Academic Council for approval.	M.Sc.(Applied Mathematics)	Mathematics


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AAA:

Percentage Change in syllabus A.Y. : 2020-21						
S. No	Course Code	Course Title	Existing Syllabus	New Syllabus	Topics added/r emoved /replaced	Change in Course Outcome(s)
1	20UC110	Integrated Professional English		COMPETENCY: 1 A) Basic Grammar- Countable and uncountable nouns, present simple and continuous, past simple and continuous- classroom practice- Understand and interpret Texts and work places situations B) Structural Pattern- Present continuous for future arrangements State verbs, Regular and irregular verbs, Voice , Modal verbs- Reporting ongoing tasks in the corporate world. C) Descriptive and Qualitative Patterns: Adjectives and Adverbs (classroom practice) Time Expressions, Comparatives and superlatives, Pronouns, Conditionals, Phrases and clauses (Including Relative) COMPETENCY: 2 a) Formal contexts: Being a PA, describing changes in a company Taking orders over the phone. b) Listening & Speaking: Participate in conversations	By the recommendations of Dean (Academics) and Parents	100%
1	1					New Course

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variation with proper contextual language markers, turn taking. Classroom practice- Presenting context, reason, problem- Case analysis (short).

c) Body Language: Do and Don't of one to one interaction, Telephone interaction Video/web conferencing. Culture specific practices.

d) Work Etiquette- situation, ambience, team skills, time management and leadership ability.

COMPETENCY: 3

- Understand and assimilate main ideas and specific details. (250-300 words text of moderate difficulty)
- Read for general understanding, interpreting, for actual or specific information, for grammatical accuracy and information transfer.
- Understand the general meaning of corporate context and office correspondence.
- Understand short reports of predictable nature.

COMPETENCY: 4

- Internal Correspondence. Making notes on routine matters, such as, taking/ placing orders

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21AM210

7

Functional
Analysis

3

Fundamentals of metric spaces, Completion metric spaces, normed spaces, Hölder inequality, Minkowski inequality and vector spaces with examples of ℓ_p and L_p spaces.

Normed linear spaces, Banach spaces with examples, Convergence and absolute convergence of series in a normed linear space. Inner product spaces, Hilbert spaces, Relation between Banach and Hilbert spaces. Schwarz inequality.

Convex sets, Existence and uniqueness of a vector of minimum length, Projection theorem. Orthogonal and orthonormal systems in Hilbert space with examples, Bessel's inequality, Parseval's identity, Characterization of complete orthonormal systems.

Continuity of linear maps on normed linear spaces, Four equivalent norms on $B(N, N')$, Conjugate and Dual spaces, The Riesz Representation Theorem.

Adjoint operators, self adjoint operators, normal operators, Unitary operators on Hilbert spaces (H) and their properties. Isometric isomorphism of H onto itself under Unitary operators and their importance. Projection operators on Banach spaces and Hilbert spaces. Orthogonal Projections.

Contraction Mappings with examples, Banach-fixed point theorems and applications. The Closed Graph Theorem, The Uniform

By the
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Academic
Peers

New
Course

100%

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		Boundedness Principle and its applications, The Hahn – Banach Extension and Separation Theorems, Open mapping Theorem and applications.		
		CRISP SET THEORY: Introduction; Relations between Sets; Operations on Sets; Characteristic Functions; Cartesian Product of Crisp Sets; Crisp Relations on Sets. FUZZY SET THEORY: Introduction; Concept on a Fuzzy Set; Relations between Fuzzy Sets; Operations of Fuzzy Sets; Properties of the Standard Operations; Certain numbers Associated with a Fuzzy Set; Certain Crisp Sets Associated with a Fuzzy Set; Certain Fuzzy Sets Associated with a Given Fuzzy Set; Extension Principle. FUZZY RELATIONS: Introduction; Fuzzy Relations; Operations on Fuzzy Relations; α-Cuts of a Fuzzy Relation; Composition of Fuzzy Relations; Projections of Fuzzy Relations; Cylindrical Extensions; Cylindrical Closure; Fuzzy Relation on a Domain. FUZZY LOGIC: Introduction; Three-valued Logics; N-valued Logics $N \geq 4$; Infinite-valued Logics; Fuzzy Logics; Fuzzy Propositions and Their Interpretations in Terms of Fuzzy Sets; Fuzzy Rules and Their Interpretations in Terms of Fuzzy Relations.	New Course	By the recommendations of Academic Peers

100%

21AM210
8
Fuzzy mathematics and applications

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SWITCHING FUNCTIONS AND SWITCHING CIRCUITS: Introduction; Switching Functions; Disjunctive Normal Form; Relation between Switching Functions and Switching Circuits; Equivalence of Circuits; Simplification of Circuits.

APPLICATIONS FUZZY METHODS IN CONTROL THEORY: Introduction; Introduction to Fuzzy Logic Controller; Fuzzy Expert Systems; Classical Control Theory vs. Fuzzy Control; Illustrative Examples; Working of an FLC through Examples; Details of the Components of

FLC; Mathematical Formulation of an FLC; Real-life Examples

Computations of Eigen Values of a Matrix: Power method for dominant, sub-dominant and smallest eigen-values, Method of inflation, Jacobi, Givens and Householder methods for symmetric matrices, LR and QR methods.

Initial Value Problems: Multistep methods, their error analysis and stability analysis.

Finite Difference method: Review of finite difference operators, finite difference methods. **Elliptic PDE:** Five point formulae for Laplacian, replacement for Dirichlet and Neumann boundary conditions, curved

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Advanced
Numerical
Analysis

21AM220

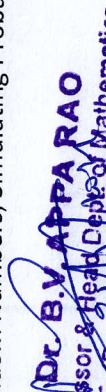
7

New
Course

By the
recommendations of
Academic
Peers

100%

boundaries, solution on a rectangular domain, block tri-diagonal form and its solution using method of Hockney, condition of convergence. Parabolic PDE: Concept of compatibility, convergence and stability, Explicit, full implicit, Crank-Nicholson, du-Fort and Frankel scheme, ADI methods to solve two-dimensional equations with error analysis. Hyperbolic PDE: Solution of hyperbolic equations using FD, and Method of characteristics, Limitations and Error analysis. Weighted residual methods: Collocation, least squares, Galerkins, Rayleigh-Ritz methods and their compatibility.			21AM220 4	Mathematical Modeling
Modeling Change, Proportionality, and Geometric Similarity: Modeling Change with Difference Equations, A Savings Certificate, Mortgaging a Home, Approximating Change with Difference Equations, Solutions to Dynamical Systems. Mathematical Models, Modeling Using Proportionality, Modeling Using Geometric Similarity. Model Fitting: Fitting Models to Data Graphically, Analytic Methods of Model Fitting, Applying the Least-Squares Criterion, Choosing a Best Model, Vehicular Stopping Distance, Comparing the Criterion. Determining a Production Schedule. Simulation Modeling: Simulating Deterministic Behavior, Area Under a Curve, Generating Random Numbers, Simulating Probabilistic		New Course	By the recommendations of Academic Peers	100%


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Behavior, Inventory Models.				
Modeling with Differential Equation: Population Growth, Graphical Solutions of Autonomous Differential Equations, Drawing a Phase Line and Sketching Solution Curves, Logistic Growth, Numerical Approximation Methods, Using Euler's Method, A Savings Certificate Revisited, Separation of Variables, Newton's Law of Cooling, Population Growth with Limited Resources, Graphical Solutions of Autonomous Systems of First-Order Differential Equations, A Competitive Hunter Model, A Predator--Prey Model. Introduction Problems of mathematical control theory, Specific models. Controllability and observability for Linear systems Linear differential equations, The controllability matrix, Rank condition, Kalman decomposition and Observability. Controllability and observability for non-Linear systems Nonlinear differential equations, Controllability and linearization, Lie brackets, The openness of attainable sets and Observability. Stability of Linear systems Stable linear systems, Stable polynomials. The Routh theorem, Stability, observability, and Liapunov equation, Stabilizability and controllability. Stability of non-Linear systems The main stability test, Linearization, The Liapunov function method, LaSalle's theorem Necessary conditions for stabilizability. Optimal controllability Bellman's equation and the value function. The linear regulator and				

21AM220

5

Mathematical control theory

New Course

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100%

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21AM220 6	Dynamical Systems	stabilization, Impulse control problems, An optimal stopping problem. Iterations of convex mappings. Iteration of functions as dynamics: One dimensional maps. Functions with several variables Periodic points of one dimensional maps: Periodic points, Iteration using the graph, Stability of periodic points, Critical points and Basins, Bifurcation of periodic points. Itineraries for one-dimensional maps: Periodic points from transition Graphs, Topological Transitivity, Cantor sets, Piecewise expanding maps and sub shifts, Applications Invariant sets for one dimensional maps: Limit sets, Chaotic Attractors, Lyapunov Exponents Invariant measures, Applications. Periodic points of Higher Dimensional maps: Dynamics of Linear maps, classification of periodic points, stable manifolds, Hyperbolic Toralauto morphisms, Applications.	New Course	By the recommendations of Academic Peers	100%
21AM220 8	Number Theory	Euclidean algorithm, Linear Diophantine equations, Prime numbers, Fundamental theorem of arithmetic, Prime number theorem (statement only). Congruences, solutions of linear congruences, Chinese Remainder Theorem, Euler's totient function, Euler-Fermat theorem,	New Course	By the recommendations of Academic Peers	100%

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21AM220 9	Applied Stochastic Processes	Wilson's theorem, non-linear congruences, Hensel's lemma, primitive roots and power residues. Polynomial congruences. Reduced residue systems. Quadratic residues, quadratic reciprocity, the Jacobi symbols. The greatest integer function, Arithmetic functions, Mobius function and Mobius inversion formula. Finite continued fractions, infinite continued fractions, approximation to irrational numbers. Introduction to cryptography, public key cryptography, RSA Time Markov Models: Discrete-Time Markov Chains, Transient Distributions, Occupancy Times, Limiting Behavior, First-Passage Times. Poisson Processes: Poisson Processes, Superposition of Poisson Processes, Thinning of a Poisson Process, Compound Poisson Processes. Continuous-Time Markov Models: Continuous-Time Markov Chains, Transient Analysis: Uniformization, Occupancy Times, Limiting Behavior, First-Passage Times. Generalized Markov Models: Renewal Processes, Cumulative Processes, Semi-Markov Processes. Models: Queueing Systems, Single-Station Queues, Birth and Death Queues. Brownian Motion: Standard Brownian Motion, Brownian Motion, First-Passage Times, Martingales and Semimartingales, Black Scholes Formula.	New Course	By the recommendations of Academic Peers	100%
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DAC MEETING AGENDA

DAC-1 meeting held on 19th May, 2021 at 10.00 A.M.

Venue: Virtual Mode

D.A.C. No. 1/2020-21

The following points were discussed in the Departmental Academic Committee meeting held on **19-05-2021** virtually at 10.00 A.M.

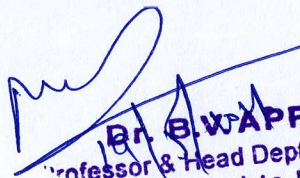
Link :

<https://teams.microsoft.com/l/meetup-join/19%3afd5909d98fe142cf822ed825dedb6d90%40thread.tacv2/1621330107334?context=%7b%22Tid%22%3a%22808cc83e-a546-47e7-a03f-73a1ebba24f3%22%2c%22Oid%22%3a%22e377466-007c-4c87-9ca2-7600fbb20be4%22%7d>

AGENDA of the meeting: to discuss academic related issues & inclusion of new courses /disciplines in the department

As per the agenda, the following points were discussed. After that, reviewed and resolved the following items

1. To revise the P.G. Program-M.Sc. (Applied Mathematics) existing syllabus along with the structure with Electives and without Streams to be admitted students for the Academic Year 2021-2022.
2. As per the Dean (Academics) guidelines to incorporate One of the English Proficiency Courses in the appropriate semester of the program.
3. As per the guidelines, the Department Academic Committee members discussed and resolved that to include Two Courses "Design Thinking and Innovation (DTI) – 1 & 2" in Semester-2 and 3 respectively into the Curriculum of Y21 admit batch of M.Sc. (Applied Mathematics) students.
4. To carry out the Department Faculty Collaborative Research Work with the Industry Persons in order to improve the R&D activity.
5. To establish MOU's between the Department Faculty and the other University Faculty to carry out collaborative projects/research work.


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A screenshot of a Zoom meeting interface. The main window displays a grid of video feeds for participants. At the top, a 'Participants' list shows names like 'Dr. BV APPA RAO', 'K Rajya Lakshmi', and 'Dr. G. Suresh Kumar'. The bottom toolbar contains icons for chat, reactions, and other meeting functions. A sidebar on the right shows the meeting title 'BOS Meeting(23-03-2022)', a 'Request control' button, and a 'People' list. A 'You're recording' notification is visible in the bottom left corner.

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BOS Meeting (Preceding an Academic Year)

AGENDA and RESOLUTIONS

AGENDA ITEM-1

1. Confirmation of Minutes of the previous meeting of the Board of Studies	Approved
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AGENDA ITEM-2

In Y21 regulation, combined DTI-1 and DTI-2 courses and renamed as D.T.I.	Approved
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It was resolved to combine DTI-1 and DTI-2 from the program as per the guidelines of the Dean (Academics).


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