SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi and Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi and Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF MATHEMATICS

MINUTES OF BOARD OF STUDIES 4th MEETING

Venue

Department of Mathematics

School of Arts and Science (Block)

Sri Manakula Vinayagar Engineering College

Date & Time

21.02.2022 & 10.00 am to 12.00 pm

DEPARTMENT OF MATHEMATICS

Minutes of Board of Studies 4th Meeting

The Board of Studies 4th meeting was held on 21.02.2022 (Monday) at 10.00 am in the Department of Mathematics, Sri Manakula Vinayagar Engineering College, with Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Members as per UGC norms
1	Dr. T. Gayathri Professor and Head Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 gayathrithiyagu@smvec.ac.in/ 9486580058	Chairman
2	Dr. S. Tamilselvan Professor & Head Department of Mathematics Annamalai University,Chidambaram- 608 002 stamilselvan@hotmail.com/9443073937	Subject Expert (University Nominee)
3	Dr. P. Balaji Assistant Professor (Stage II) Department of Mathematics SCSVMV university, Kanchipuram-631561 pbr1002017@gmail.com/9486082115	Subject Expert (Academic Council Nominee)
4	Dr. S. Srinivasan Assistant Professor Department of Mathematics Periyar Government Arts and Science College, Cuddalore -607003 smrail@gmail.com/7010939424	Subject Expert (Academic Council Nominee)
5	Mr. G. Indragoby Senior Technical Architect HCL Technologies, Chennai indragoby@gmail.com/**98432223234**	Member (Representative from Industry)
6	Mr.P.Krishnamoorthy Assistant Professor Department of Mathematics Sri ManakulaVinayagar Engineering College Puducherry -605107 krishnamoorthymaths@smvec.ac.in /9750028056	Internal Member
7	Dr.B.Kanimozhi Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 kanimozhimaths@smvec.ac.in /7708824215	Internal Member

8	Prof.N.Vijayan Associate Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 vijayan@smvec.ac.in /8678935461	Internal Member
9	Mr.M.EgaliteFrancis Associate Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 francisece@smvec.ac.in/9940912911	Internal Member
10	Mr.K.Ganesan Assistant Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 ganesanmaths@smvec.ac.in /9942575123	Internal Member
11	Ms.D.Dheebia Assistant Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 dheebia@smvec.ac.in /8098405675	Internal Member
12	Mrs. S Geetha Assistant Professor Department of Physics Sri Manakula Vinayagar Engineering College Puducherry– 605107 geethaphysics@smvec.ac.in /9942355656	Co - opted Member
13	Dr. K. Karthikeyan Associate Professor Department of Chemistry Sri Manakula Vinayagar Engineering College Puducherry– 605107 karthikeyank2005@gmail.com /9344707262	Co - opted Member
14	Mr.M.Elamaran Assistant Professor Department of English Sri Manakula Vinayagar Engineering College Puducherry - 605107 elamaraneng@smvec.ac.in/ 9500712597	Co - opted Member

Agenda of the Meeting

Item No : BOS /2022 /SAS / UG / MA / 4.1

Welcome Address, Introduction about the Institution and Department, Introduction of BoS Members.

Item No : BOS /2022 /SAS / UG / MA / 4.2

To Confirm the minutes of Board of Studies 3rd meeting.

Item No : BOS /2022 /SAS / UG / MA / 4.3

To discuss and approve the Syllabi for V and VI semesters for the B.Sc., Mathematics under Autonomous Regulations R-2020

Item No : BOS /2022 /SAS / UG / MA / 4.4

To discuss and approve V and VI semesters courses under the category of

- Skill Enhancement Courses
- Employability Enhancement Courses

Item No : BOS /2022 /SAS / UG / MA / 4.5

Any other item with the permission of chair.

Minutes of the Meeting

Item No: 4.1

Dr. T. Gayathri, the Chairman, BoS officially announced the opening of the meeting and welcomed the external, internal members and also thanked them for accepting the invite and their presence as member of the Board of Studies. The meeting thereafter deliberated on agenda items that had been approved by the Chairman.

Item No: 4.2

The Chairman, BoS, appraised the minutes BoS 3rd meeting, then it is confirmed with the approval for the incorporation of minor revisions needed as mentioned below.

SI.No	Regulation	Semester	Course Title/ Course Code	Unit	Particulars
1	R20	I	Trigonometry/ A20MAT102	III	Include the topic relation between circular and **Hyperbolic function** in Unit III
2	R20	I	Ancillary Physics – I / A20PHD101	The Complete Course	Rename the course as **Allied Physics** instead of **Ancillary Physics – I**

	3	R20	II	Ordinary Differential Equations/ A20MAT204	V	Rename the Unit V title as **Differential Equations with Variable coefficients** instead of **Differential Equations with constant coefficients**
	4	R20	III	Partial Differential equations/ A20MAT305	III, IV and V	Rename the Unit III title as **One dimensional wave Equation** instead of **Applications of PDE** Rename the Unit IV title as **One dimensional Heat Equation** instead of **One dimensional Heat flow** Rename the Unit V heading as **Two dimensional Heat Equation** instead of **Steady State Heat flow in Two Dimension.**
	5	R20	III	Fourier Series and Fourier Transforms/ A20MAT306	I and II	Rename the Unit I heading as **Periodic Function and Special wave forms** instead of **Fourier Series.** Rename the Unit II heading as **Fourier Series** instead of **Fourier Series for Periodic Functions.**
	6	R20	III	Numerical Methods/ A20MAE301	I	Include the **Regula False Method and Power Method** and remove the **Iterative Method** in Unit I.
	7	R20	III	Statistics –I Lab/ A20MAL301	The Complete Exercises	Change the complicated exercises into simple exercises.
	8	R20	IV	Operations Research/ A20MAT409	I	Remove the topic **Travelling salesman problem** in Unit I
	9	R20	IV	Statistics-II Lab/	The Complete	Change the complicated exercises

			A20MAL402	Exercises	into simple exercises.

The above changes are incorporated in the curriculum and syllabus as per the suggestion of BoS members. The details are given in the **Annexure I**

Item No: 4.3

The syllabi of the B.Sc. Mathematics for the semesters V and VI were presented by the chairman of BoS and the following suggestions were given by BoS members

SI.No	Regulation	Semester	Course Title/ Course Code	Unit	Particulars
1	R20	V	Real analysis - I / A20MAT512	Text book	Real Analysis, J.N.Sharma, A.R.Vasishtha, text books was Suggested instead of "Advanced Real Analysis" by Anthony W.Knapp
2	R20	V	Complex analysis/ A20MAT513	Unit-III	Suggested to Rename the Unit III heading as Complex Integration instead of Contour Integral.
				Unit-V	Suggested to Rename the Unit V heading as Contour Integral instead of Evaluation of Contour Integral.
3	R20	VI	Machine learning / A20MAE505	Unit-IV	Suggested to exclude the following topics: Isomap – Least Squares Optimization – Evolutionary Learning
4	R20	VI	Graph theory / A20MAT616	Unit-V	Change the Unit –V as Trees and suggested to shift planar graphs into Unit-IV

These suggestions were incorporated in the syllabi and approved by the expert members and Recommended to Academic Council.

[Details are provided in **Annexure II**]

Item No: 4.4

Skill Enhancement Courses in V and VI semester

Discipline Specific Elective – III (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	A20MAE505	Machine Learning
2	A20MAE506	Artificial Intelligence
3	A20CME523	Income Tax Law and Practice
Discipline Specific Elective – IV (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	A20MAE607	Fuzzy Algebra
2	A20MAE608	Astronomy
3	A20CME624	Financial Management

Skill Enhancement Courses for the V and VI semesters courses were presented by the chairman of BoS and the following suggestions were given by BoS members.

SI.No	Regulation	Semester	Course Title/ Course Code	Unit	Particulars
1	R20	V	Artificial intelligence/ A20MAE506	Unit-V	Suggested to Remove the following topics: Perception–Planning–Moving
2	R20	VI	Astronomy / A20MAE608	Unit-I	Suggested to Remove the following topics: Diurnal Motion - Rising and setting of a star - Sidereal time - Circumpolar Star - Morning and Evening starts - Twilight - Earth - Length of the day.
				Unit-V	Suggested to Remove the following topics: Stellar Universe - A brief history of Astronomy- Astronomical Instruments.

These suggestions were incorporated in the syllabi and approved by the expert members and Recommended to Academic Council.

[Details are provided in **Annexure III**]

Item No: 4.5	**Any other agenda – Nil**

The meeting was concluded at 12:00 pm with vote of thanks by **Dr. T. Gayathri**, Chairman, Board of Studies, Department of Mathematics, Sri Manakula Vinayagar Engineering College.

Sl.No	Name of the Member with Designation and official Address	Members as per UGC norms	Signature
1	Dr. T. Gayathri Professor and Head Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 gayathrithiyagu@smvec.ac.in/ 9486580058	Chairman	
2	Dr. S. Tamilselvan Professor & Head Department of Mathematics Annamalai University, Chidambaram- 608 002 stamilselvan@hotmail.com/9443073937	Subject Expert (University Nominee)	
3	Dr. P. Balaji Assistant Professor (Stage II) Department of Mathematics SCSVMV university, Kanchipuram-631561 pbr1002017@gmail.com/9486082115	Subject Expert (Academic Council Nominee)	
4	Dr. S. Srinivasan Assistant Professor Department of Mathematics Periyar Government Arts and Science College, Cuddalore -607003 smrail@gmail.com/7010939424	Subject Expert (Academic Council Nominee)	
5	Mr. G. Indragoby Senior Technical Architect HCL Technologies, Chennai indragoby@gmail.com/98432223234	Member (Representative from Industry)	
6	Mr.P.Krishnamoorthy Assistant Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 krishnamoorthymaths@smvec.ac.in /9750028056	Internal Member	
7	Dr.B.Kanimozhi Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 kanimozhimaths@smvec.ac.in 7708824215	Internal Member	
8	Prof.N.Vijayan Associate Professor Department of Mathematics Sri Manakula Vinayagar Engineering	Internal Member	

	College Puducherry– 605107 vijayan@smvec.ac.in /8678935461		
9	Mr.M.Egalite Francis Associate Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 francisece@smvec.ac.in/9940912911	Internal Member	
10	Mr.K.Ganesan Assistant Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 ganesanmaths@smvec.ac.in /9942575123	Internal Member	
11	Ms.D.Dheebia Assistant Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Puducherry– 605107 dheebia@smvec.ac.in /8098405675	Internal Member	
12	Mrs. S Geetha Assistant Professor Department of Physics Sri Manakula Vinayagar Engineering College Puducherry– 605107 geethaphysics@smvec.ac.in /9942355656	Co - opted Member	
13	Dr. K. Karthikeyan Associate Professor Department of Chemistry Sri Manakula Vinayagar Engineering College Puducherry– 605107 karthikeyank2005@gmail.com /9344707262	Co - opted Member	
14	Mr.M.Elamaran Assistant Professor Department of English Sri Manakula Vinayagar Engineering College Puducherry - 605107 elamaraneng@smvec.ac.in/ 9500712597	Co - opted Member	

Chairman/BOS
(Dr. T.Gayathri)

Dean SAS
(Dr. S. Muthulakshmi)

ANNEXURE I

A20MAT102	TRIGONOMETRY	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To familiarize the Expansions of trigonometric functions and their Applications.
- To learn the types of hyperbolic functions.
- To study the basic concept of hyperbolic functions.
- To know the DeMoivre's Property and logarithm.
- To understand the concept of series in trigonometric functions.

Course Outcomes

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

CO1 – Expand Trigonometric functions.
CO2 – Apply the Basic rules of Expansions of power series.
CO3 – Understand the basic concepts o Hyperbolic Functions.
CO4 – Solve the problems by using DeMoivre's Property.
CO5 – Understand various methods for the summation of infinite trigonometric series.

UNIT I EXPANSION OF θ AND EQUATIONS (12 Hrs)

Expansions of $\cos n\theta$, $\sin n\theta$ – Expansion of $\tan n\theta$ in terms of $\tan\theta$ – Expansion of $\tan(A+B+C+...)$ – Formation of Equations.

UNIT II MULTIPLES OF θ AND CIRCULAR FUNCTIONS (12 Hrs)

Powers of sine's and cosines of θ in terms of functions of multiples of θ – Expansion of $\sin\theta$ and $\cos\theta$ in a series of ascending powers of θ – Expansion of Inverse Circular Functions.

UNIT III HYPERBOLIC FUNCTIONS (12 Hrs)

Definition – Hyperbolic function – Relation between Circular and Hyperbolic Functions – Inverse Hyperbolic Functions.

UNIT IV PROPERTIES ON CIRCLE AND FACTORS (12 Hrs)

Resolving into Factors – Simple Problems only – De Moivre's Property on the Circle and Cote's Property on the Circle – Logarithm of complex quantities.

UNIT V SUMMATION OF TRIGONOMETRIC SERIES (12 Hrs)

Summation of Trigonometric Series: Method of Differences – Gregory Series – Euler Series.

Text Books

1. S. Narayanan and, T. K. Manicavachagom Pillai, "Trigonometry", S.Viswanathan Printers & Publishers Pvt.Ltd. Chennai, 2004.
2. P. Kandasamy, K. Thilagavathy, "Mathematics for B.Sc. Vol.- I, II, III & IV", S. Chand & Company Ltd., New Delhi-55, 2004.
3. N. P. Bali, "Trigonometry", Krishna Prakasan Mandhir, 9, Shivaji Road, Meerut (UP),1994.

Reference Books

1. S. L. Loney, "Plane Trigonometry", Part II, Cambridge University Press, London.
2. S. Duraipandian and Laxmi Duraipandian, "Trigonometry". Emerald Publishers, Chennai,1984.
3. B. S. Grewal "Higher Engineering Mathematics". Khanna Publishers, New Delhi, 2003.

Web References

1. http://web.mit.edu/jorloff/www/18.01a-esg/OCWTrig.pdf
2. https://faculty.atu.edu/mfinan/trigbook.pdf
3. https://users.auth.gr/~siskakis/GelfandSaul-Trigonometry.pdf

A20PHD101	ALLIED PHYSICS (For B. Sc. Mathematics Students)	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- The course presents an introduction to the physics of the objects whose sizes span from atomic dimensions to macroscopic, human scale dimensions, and beyond: atoms, molecules, gases, liquids, and solids.
- The aim is to show how the properties of macroscopic bodies can be derived from the knowledge that matter is made up from atoms.
- Recognize the difference between physical and chemical properties.
- Distinguish between extensive and intensive properties.
- To learn the mathematical formulations of dynamics problems.

Course Outcomes

On Completion successful students will be able to demonstrate an understanding of:

CO1 – To describe the various phenomenon of Kinematics, Mechanics of Solids.
CO2 – To describe the various phenomenon of Sound & Acoustics of different structures.
CO3 – The relationships between physics on the atomic scale and the properties of matter. Techniques for finding appropriate averages to predict macroscopic behavior.
CO4 – To describe the relationship and thermal behavior of various systems.
CO5 – To describe various concepts of Optics, spectroscopy, Application of light, Fiber Optics etc.,

UNIT I MECHANICS (12 Hrs)

Projectile –range of horizontal and inclined plane- impulse – impact – Impulsive force – laws of impact – direct and oblique impact of smooth sphere – loss in kinetic energy - impact of smooth sphere on a smooth horizontal plane - Rotational motion and moment of inertia - calculation of Moment of inertia of ring - Hollow cylinder and sphere and Fly wheel - Acceleration of a body rolling down on an inclined plane - Compound Pendulum.

UNIT II SOUND (12 Hrs)

Introduction to longitudinal waves – Sound waves in gases – Energy distribution in sound waves – Intensity of sound waves – Longitudinal waves in a solid – Example: earthquake – Doppler Effect - Reflection and transmission of sound waves at boundaries – Diffraction of sound waves - Noise and music – Limits of human audibility – The decibel unit - Reverberation time - Sabine's formula for growth and decay – Acoustics of auditoriums and halls – Introduction to acoustic transducers.

UNIT III PROPERTIES OF MATTER (12 Hrs)

Stress – Strain – Hooke's law – Relation between elastic constants – poisson's Ratio – Expression for poisson's ratio in terms of elastic constants – work done in twisting –torsional pendulum – determination of rigidity modulus – Young's modulus – determination – uniform – non-uniform bending - Bending of beam, Torsion of cylinder, Bending beam, Determination of ΄Y, Ƞ and σ.

UNIT IV THERMAL PHYSICS (12 Hrs)

Thermal conductivity – good & bad conductors – Forbe's method - Lee's disc method– relationship between thermal and electrical conductivities - Wiedemann Franz's law - Radiation- Prevost's theory of heat exchanges - law of cooling – Black body radiation - Kirchhoff's law - Wien's laws of energy distribution in black body radiation - Wien's displacement law- Rayleigh-Jean's law -Plank's law – pyrometry - solar constant – sources of solar energy & applications.

UNIT V OPTICS **(12 Hrs)**

Snell's law of reflection and refraction, reflection and refraction at spherical surfaces: formula for refraction at single spherical surface, sign convention - Electromagnetic spectrum – spectral responds of human eye – UV and IR spectroscopy – Raman Effect – Experimental arrangement – application of Raman effect - Fiber optic communication: Introduction – optic fiber – numerical aperture – coherent bundle – fiber optic communication system and its advantage – multimode fiber optic sensors.

Text Books

1. Sound, Saigal, S. Chand& Co, 1996
2. Mechanics, D.S. Mathur, S. Chand & Co, 2000
3. Properties of Matter, Brijlal Subramaniyam, S.Chand & Co, 2002

Reference Books

1. Fundamentals of Physics, Resnick Halliday & Walker, Wiley Publishing Co,
2. Principles of Physics, Resnick Halliday & Walker, Wiley Publishing Co,
3. Concepts of Physics, HC Verma, Bharati Bhavan Publisher

Web References

1. https://ocw.mit.edu/courses/physics/
2. https://www.einstein-online.info/en/category/elementary/
3. https://www.physicsclassroom.com/

A20MAT204	ORDINARY DIFFERENTIAL EQUATIONS	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To identify an ordinary differential equation and its order.
- To evaluate first order differential equations.
- To find solutions of exact equations.
- To know about the particular integral.
- To solve differential equations using variation of parameter.

Course Outcomes

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

CO1 – Understand the order, degree of differential equation.
CO2 – Determine solutions to first order linear differential equations.
CO3 – Familiarize the orthogonal trajectory of the system of curves on a given surface.
CO4 – Solving linear differential equation with constant coefficient.
CO5 – Find the complete solution of a differential equation with constant coefficients by variation of Parameter.

UNIT I FIRST ORDER DIFFERENTIAL EQUATIONS (12 Hrs)

Differential Equation, Order and Degree of a Differential equation – Formation of a differential equation – Wronskian – definition – linearly dependent and independent set of functions.

UNIT II EXACT DIFFERENTIAL EQUATIONS (12 Hrs)

Equation of first order and first degree – separation of variables – Necessary and sufficient conditions for a differential equation of first order and first degree to be exact – integrating factor – linear Differential equation – Equation reducible to linear form (Bernoulli's equation).

UNIT III DIFFERENTIAL EQUATIONS (12 Hrs)

Trajectories – orthogonal trajectories (cartesian and polar co-ordinates) – Equation solvable for p – Equation solvable for x and y – Equation in Clairaut's form - General and singular solution.

UNIT IV DIFFERENTIAL EQUATIONS (HIGHER ORDER) (12 Hrs)

Linear differential equations with constant coefficients – finding complementary function and Particular Integrals of the form $e^{mx}, \sin mx, x^m, e^{ax}\,X$ where X is a function of x - Solving Homogeneous linear equations (Cauchy- Euler Equations).

UNIT V DIFFERENTIAL EQUATIONS WITH VARIABLE COEFFICIENTS (12 Hrs)

Equation reducible to Homogeneous linear form (Legendre's linear equations) – Method of variation of parameters – Solving ordinary simultaneous differential equation with constant coefficients.

Text Books

1. M. D. Raisinghania, "Ordinary and Partial Differential Equations", S. Chand & Company Ltd, 2020.
2. E. A. Coddington, " An Introduction to Ordinary Differential Equations", Prentice Hall of India,1991.
3. S. C. Deo, Y. Lakshmi Nathan and V. Raghavendra, "Text Book of Ordinary Differential Equation", Tata McGraw Hill, New Delhi, 2nd Edition, 2002.

Reference Books

1. S.Narayanan, T.K. Manickavachagom Pillal,"Differential Equations and its Applications" ,Viswanathan Printers& Publishers Pvt. Ltd., 2015.
2. Dr. Arumugam and Mr. A. Thangapandi Issac, "Differential Equations and its Applications",New Gamma Publishing House,2014.
3. E. A. Coddington and H. Davinson, "Theory of Ordinary Differential Equations", McGraw Hill, 1955.

Web References

1. https://mathworld.wolfram.com/OrdinaryDifferentialEquation.html
2. https://nptel.ac.in/courses/111/106/111106100/
3. https://www.youtube.com/watch?v=FU-7xJLpoWg

A20MAT305 **PARTIAL DIFFERENTIAL EQUATION**

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To know the general solution, singular solution & complete solution.
- To solve the simultaneous linear partial differential equation.
- To gain knowledge in application of Partial Differential equation.
- To learn the nature of one dimensional heat flow equation.
- To learn the nature of two-dimensional heat equation in Cartesian form.

Course Outcomes

After completion of the course, the students shall have able to

CO1 – Classify the Solution of partial differential equations.
CO2 – Know the linear partial differential equations.
CO3 – Know the Transformation of wave and heat equation.
CO4 – Solve one dimensional heat equation.
CO5 – Solve two dimensional heat equation.

UNIT I SOLUTION OF PARTIAL DIFFERENTIAL EQUATION (12 Hrs)

Introduction – Formation of partial differential equations – Elimination of Arbitrary constants and Functions – Solution of PDE – General Solution – Singular solution – Complete solution - General Solution of PDE.

UNIT II LINEAR PARTIAL DIFFERENTIAL EQUATION (12 Hrs)

Lagrange's Linear Equation – solution of simultaneous equation – Linear PDE of Higher order with constant coefficient – complementary function for a non- homogeneous linear equation – Method of separation of variables

UNIT III ONE DIMENSIONAL WAVE EQUATION (12 Hrs)

Introduction – Transverse vibration of stretched string – One dimensional wave equation – Transmission Line Equation – Variable Separable solution of the wave equation – Solution of Damped vibrating string equation

UNIT IV ONE DIMENSIONAL HEAT EQUATION (12 Hrs)

Introduction – Equation of Variable Heat flow in one dimension – Variable separable solutions of the Heat equation

UNIT V TWO DIMENSIONAL HEAT EQUATION (12 Hrs)

Introduction – Equation of variable heat flow in two dimensions in Cartesian form – variable separable solution of Laplace equation

Text Books

1. T.Veerarajan, "Transforms and Partial Differential Equation", Tata McGraw Hill, 2011
2. C. Zachmanoglou, Dale W. Thoe, "Introduction to Partial Differential Equations with Applications", Dover Publication, New York, 1986.
3. Maciej Borodzik, Paweł Goldstein, PiotrRybka, Anna Zatorska-Goldstein, "Problems on Partial Differential Equation", Springer publications, 1986.

Reference Books

1. K. S. Rao, "Introduction to Partial Differential Equations", PHI Learning Pvt Ltd, New Delhi, 2010
2. T. Amaranath, "An Elementary Course in Partial Differential Equations", 2nd Edition, Narosa Publishing House, New Delhi, 2014.
3. Amaranath.T, "An Elementary Course in Partial Differential Equations", 2nd edition, Narosa Publishing House, 2012

Web References

1. https://www.youtube.com/watch?v=ly4S0oi3Yz8
2. https://nptel.ac.in/courses/111/103/111103021/
3. https://ocw.mit.edu/courses/mathematics/18-152-introduction-to-partial-differential-equations-fall-2011/lecture-notes/

A20MAT306	FOURIER SERIES & FOURIER TRANSFORMS	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To learn the concept of periodic functions.
- To understand the rules of Fourier series.
- To analyze the asymptotic performance of half range Fourier series.
- To understand the fundamental concept of Fourier Transform.
- To analyze various problems in Fourier Transform.

Course Outcomes

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

CO1 – Know the different types of functions.
CO2 – Calculate the Fourier coefficients.
CO3 – Find the Half range Fourier series.
CO4 – Familiarize the basics of Fourier Transform.
CO5 – Know the applications of inverse Fourier Transform.

UNIT I PERIODIC FUNCTION AND SPECIAL WAVE FORMS (12 Hrs)

Introduction, Periodic functions- Properties, Even & Odd functions- Properties, Special wave forms- Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave.

UNIT II FOURIER SERIES (12 Hrs)

Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period 2l, Dirichlet's conditions, Sum of Fourier Series – Problems.

UNIT III HALF RANGE FOURIER SERIES (12 Hrs)

Half Range Fourier series - Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity, examples. Harmonic Analysis.

UNIT IV FOURIER TRANSFORM (12 Hrs)

Fourier Integral Theorem, Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem, Fourier Cosine and Sine Transforms. Fourier Cosine and Sine Transforms of elementary functions. Properties of Fourier Transform- Linearity, Shifting, Change of scale, Simple problems.

UNIT V INVERSE FOURIER TRANSFORM (12 Hrs)

Fourier Transform of Derivatives, examples – Convolution Theorem (statement only), inverse of Fourier Transform, examples.

Text Books

1. Dr. A. Singaravelu, "Transforms and Partial Differential Equations", 18th reprint, Meenakshi Agency, 2011.
2. A. NeelArmstrong, "Transforms and Partial Differential Equations" Third edition, D.D.Publications,2012
3. Elias M. Stein, "Fourier Analysis: An Introduction ", published by Princeton University Press, New Jersey 2003

Reference Books

1. R. Harding, "Fourier Series and Transforms", Taylor and Francis Group, New York, 1985
2. Ronald N. Bracewell, "The Fourier Transform and Its Applications", McGraw-Hill International Editions - Paperback – July 1, 1986.
3. Javier Duoandikoetxe, "Fourier analysis", McGraw-Hill International Editions - Paperback – January 2012.

Web References

1. https://mathworld.wolfram.com/FourierSeries.html
2. https://mathworld.wolfram.com/FourierTransform.html
3. https://see.stanford.edu/materials/lsoftaee261/book-fall-07.pdf

A20MAE301	NUMERICAL METHODS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To know the solution of algebraic and transcendental equations.
- To learn the techniques of solving simultaneous equations.
- To introduce the numerical techniques of differentiation and integration.
- To solve ordinary differential equations by using numerical methods.
- To know the solution of partial differential equations by using numerical methods.

Course Outcomes

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

CO1 – Use numerical techniques to solve algebraic and transcendental equations.
CO2 – Find the solution of simultaneous equations.
CO3 – Analyze and apply the knowledge of differentiation and integration by using numerical methods.
CO4 – Solve the solution of ordinary differential equations by Runge Kutta methods.
CO5 – Solve the partial differential equations in iterative methods.

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS (9 Hrs)

Introduction to numerical analysis –The solution of algebraic and transcendental equations – Bisection method – False Position Method – Newton-Raphson method – Power Method.

UNIT II LINEAR SIMULTANEOUS EQUATIONS (9 Hrs)

Solution of simultaneous linear algebraic equations – Direct methods – Gauss elimination method – Gauss-Jordan method – Iterative methods – Jacobi method – Gauss-Seidal method.

UNIT III INTERPOLATION (9 Hrs)

Finite differences – Differences of a polynomial – Factorial polynomial – Interpolation for equal intervals –Gregory-Newton interpolation formulae – Interpolation with unequal intervals – Lagrange's interpolation formula – Inverse interpolation.

UNIT IV SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (9 Hrs)

Single step methods –Taylor series method Picard's method – Euler method and Improved Euler method – Runge Kutta method of fourth order only.

UNIT V SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS (9 Hrs)

Solution of Laplace and Poisson equations – Leibmann's iterative method – Diffusion equation: Bender-Schmitt method and Crank-Nicholson.

Text Books

1. P. Kandasamy, K. Thilagavathy, K. Gunavathy, "Numerical Methods", S. Chand & Company limited, New Delhi, 2009.
2. Rajesh Kumar Gupta, "Numerical Methods - Fundamentals and Applications", Cambridge University Press, 2019.
3. Grewal B.S., "Numerical Methods in Engineering and Science", Mercury learning and Information, Kindle Edition, 2018.

Reference Books

1. C. Xavier, "C Language And Numerical Methods", New Age International, 2007.
2. P. Siva Ramakrishna Das, "Numerical Analysis", Kindle Edition, 2016.
3. Timo Heister, Leo G. Rebholz, Fei Xue, "Numerical Analysisan Introduction", Publisher De Gruyter, 2019.

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1. http://www.bdu.ac.in/academics/equivalent-papers/courses/pg_science/MCA/RQG28.pdf
2. https://www.youtube.com/watch?v=Gkit1hUTsX8
3. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032250571912siddharth_bhatt_engg_Numerical_Differentation_and_Integration.pdf

A20MAL301	STATISTICS – I [Using MATLAB]	L	T	P	C	Hrs
		0	0	4	2	30

Course Objectives

- To familiarize the concept of Descriptive Statistics.
- To know Correlation and Regression analysis.
- To learn the concept of Special Random Variables.
- To understand Skewness and Kurtosis.
- To introduce the concepts of Conditional Probability.

Course Outcomes

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

CO1 – Gain knowledge in the concepts of Random Variables and Expectation.
CO2 – Trained for data collection on various fields of survey enabling them to classify them statistically.
CO3 – Familiarized in various statistical software.
CO4 – Find the correlation between two variables.
CO5 – Compute regression.

LIST OF EXERCISES

1. Mean
2. Median
3. Mode
4. Quartile Deviation
5. Standard deviation
6. Mean deviation
7. Skewness
8. Kurtosis
9. Correlation
10. Regression

Text Books

1. S.C Gupta and V.K. Kapoor, “Elements of Mathematical Statistics “, Sultan Chand Publishers, New Delhi. 2009.
2. Aliaga, Gunderson, “Interactive Statistics”, 2nd Edition – Pearson/Prentice Hall
3. Hamilton, “Statistics with STATA”, 8thEdition, Duxbury 2004.

Reference Books

1. P.R.Vittal, “Mathematical Statistics Ⅱ”, Margham Publications -2002- Reprint 2012.
2. Weisberg, S, “Applied Linear Regression”, John Wiley and Sons, New York - 1980.
3. Kokoska, “Introductory Statistics: A Problem-Solving Approach”, Review copy, Freeman2011.

Web References

1. https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf
2. https://www.mn.uio.no/astro/english/services/it/help/mathematics/matlab/getstart.pdf
3. https://www.mathworks.com/videos/introduction-to-matlab-81592.html

A20MAT409 **OPERATIONS RESEARCH**

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To Learn LPP using different techniques.
- To impart knowledge in concepts and tools of Operations Research.
- To understand queuing models.
- To gain knowledge in Game theory.
- To study the networks of project activities PERT – CPM.

Course Outcomes

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

CO1 – Solve Linear Programming Problems.
CO2 – Solve Transportation and Assignment Problems.
CO3 – Understand the application of queuing models.
CO4 – Understand the usage of game theory and Simulation for Solving Business Problems.
CO5 – Understand the network planning techniques of PERT and CPM.

UNIT I LINEAR PROGRAMMING PROBLEM **(12 Hrs)**

Formulation and Graphical Method – Simplex Method – Artificial Variable Techniques – Big-M Method –Duality

UNIT II TRANSPORTATION AND ASSIGNMENT PROBLEM **(12 Hrs)**

Mathematical Formulation of Transportation Problem – Methods of solution of Transportation Problem – Balanced and unbalanced Transportation problem – Maximization in Transportation – Degeneracy and non degeneracy transportation problem – Assignment Algorithm – Unbalanced Assignment Models.

UNIT III QUEUEING THEORY **(12 Hrs)**

Queueing Theory – Introduction – Queueing system – Characteristics of Queueing system – symbols and Notation – Classifications of queues – Problems in (M/M/1): (∞/FIFO); (M/M/1): (N/FIFO); (M/M/C): (∞/FIFO); Models.

UNIT IV GAME THEORY **(12 Hrs)**

Game Theory – Two person zero sum game – The Maxmin – Minimax principle – problems – Solution of m x n rectangular Games – Domination Property – (2 x n) and (m x 2) – Graphical method – Problems.

UNIT V PROJECT MANAGEMENT **(12 Hrs)**

Network scheduling by PERT / CPM – Introduction – Network and basic components – Rules of Network construction – Time calculation in Networks – CPM. PERT – PERT calculations – Cost Analysis – Crashing the Network – Problems.

Text Books

1. Kanti Swarup, P. K. Gupta, Man Mohan, *Operations Research*, S. Chand & Sons Education Publications, New Delhi, 12th Revised edition, 2014.
2. Gupta P.K. and Hira D.S., *Problems in Operations Research*, S.Chand& Co.
3. R.Paneerselvam, “Operation Research”, Prentice Hall iindia Pvt. Ltd., 2004.

Reference Books

1. V.Sundaresan, K.S.Ganapathy Subramanian &K.Ganesan, Resource Management Techniques, AR Publications, Chennai, 2015.
2. V.Sundaresan, K.S.Ganapathy Subramanian & K.Ganesan, Applied Operations Research for Management, A.R.S. Publications, Arapakkam, Tamilnadu, 2006.
3. Ravindran A., Phillips D.T. and Solberg J.J., Operations research, John wiley& Sons

Web References

1. https://www.researchgate.net/publication/313880623_Introduction_to_Operations_Research_Theory_and_Applications
2. https://easyengineering.net/operations-research-p-ramamurthy/
3. https://examupdates.in/operation-research-notes/

A20MAL402	STATISTICS II LAB [Using R]	L	T	P	C	Hrs
		0	0	4	2	30

Course Objectives

- To familiarize the concept of Mean and Standard deviation.
- To know Statistical Inferences -Continuous Probability Distribution.
- To learn the concept of Frequency Distribution.
- To understand Poisson distribution.
- To introduce the concepts of Hypothesis Testing.

Course Outcomes

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

CO1 – Gain knowledge in the concepts of Continuous Probability Distribution.
CO2 – Trained for data collection on various fields of survey enabling them to classify them Statistically.
CO3 – Familiarized in various statistical software.
CO4 – Find the Mean and Standard Deviation.
CO5 – Compute Hypothesis Testing.

LIST OF EXERCISES

1. Binomial Distribution
2. Poisson distribution
3. Geometric Distribution
4. Normal Distribution
5. Gamma Distribution
6. Beta Distribution
7. Weibull Distribution
8. Exponential Distribution
9. φ^2 Distribution
10. t - Test

Web References

1. https://spia.uga.edu/faculty_pages/rbakker/pols4150/RLabManual.pdf
2. https://www.lbrce.ac.in/SP%20with%20R%20Lab%20syllabus.pdf
3. https://www.youtube.com/watch?v=_V8eKsto3Ug

ANNEXURE II

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	A20MAT511	Abstract Algebra	DSC	3	1	0	4	25	75	100
2	A20MAT512	Real Analysis-I	DSC	3	1	0	4	25	75	100
3	A20MAT513	Complex Analysis	DSC	3	1	0	4	25	75	100
4	A20MAE5XX	DSE III*	DSE	3	1	0	4	25	75	100
Skill Enhancement Courses										
5	A20MAS505	Quantitative Aptitude & Reasoning - II	SEC	3	0	0	3	100	0	100
Employability Enhancement Course										
6	A20MAC505	Certificate Course-V	EEC	0	0	2	-	100	0	100
							19	300	300	600

SEMESTER – VI										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	A20MAT614	Linear Algebra	DSC	3	1	0	4	25	75	100
2	A20MAT615	Real Analysis-II	DSC	3	1	0	4	25	75	100
3	A20MAT616	Graph Theory	DSC	3	1	0	4	25	75	100
4	A20MAE6XX	DSE IV*	DSE	3	1	0	4	25	75	100
Skill Enhancement Courses										
5	A20MAS606	Mathematical Modelling	SEC	3	0	0	3	100	0	100
Employability Enhancement Course										
6	A20MAC606	Certificate Course-VI	EEC	0	0	2	-	100	0	100
							18	300	300	600

A20MAT511	ABSTRACT ALGEBRA	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To know the concept of Group Theory
- To study the concepts of Cyclic groups
- To understand the concept of subgroups and normal subgroups
- To learn the concept of Rings and Fields
- To understand the concepts of Ideals and Quotient Rings

Course Outcomes

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

CO1 – Recognize the basic properties of groups and subgroups
CO2 – Demonstrate abstract thinking capacity and ability to prove theorems
CO3 – Analyze the concepts of homomorphism, isomorphism, and automorphism
CO4 – Understand the basic properties of rings, fields and integral domains
CO5 – Identify Ideals and Euclidean rings

UNIT I GROUP THEORY (12 Hrs)

Definition of a Group, Examples of Groups and Preliminary Lemmas – Subgroup – Order of an element – Centre of a group – Normalizer and Centralizer – Product of two subgroups – Order of HK – Intersection and union of subgroups.

UNIT II CYCLIC GROUPS (12 Hrs)

Cyclic subgroup – Generators of a cyclic group – Number of generators of cyclic groups – Cosets – Partitioning of a group by Cosets – Lagrange's theorem – Euler's theorem – Fermat's theorem - A counting principle.

UNIT III NORMAL SUBGROUPS (12 Hrs)

Normal subgroups – Quotient Groups – Group Homomorphism–Canonical homomorphism –Kernal of a homomorphism – Isomorphism – Automorphisms – Cayley's theorem – Permutation groups.

UNIT IV RING THEORY (12 Hrs)

Definition and examples – Types of rings – Elementary properties of a ring – Integral domain – Field – Sub rings – Subfields –Homomorphism of rings and their types – Fundamental theorem.

UNIT V IDEALS AND QUOTIENT RINGS (12 Hrs)

Ideals – Principal ideal – Quotient rings – Maximal and prime ideals– Field of quotients of an integral domain – Euclidean rings.

Text Books

1. I.N. Herstein, "Topics in Algebra", Second Edition, Wiley India Pvt. Ltd., New Delhi, 2014.
2. S.Arumugam and A. Thangapandi Isaac, "Modern Algebra",Scitech Publication IndiaPvt. Ltd., Chennai, August 2004**.**
3. T.K.ManickavasagamPillai, T.Natarajan, andK.S.Ganapathy, "Algebra", Vol.1, S.ViswanathanPvt. Ltd., Chennai, 2004.

Reference Books

1. M.L.Santiago, "Modern Algebra", Tata McGraw Hill, New Delhi, 2002.
2. Lloyd R.Jaisingh and Frank Ayres, Jr. "Abstract Algebra", (2nd Edition), Tata McGraw Hill Edition,NewDelhi, 2005.
3. John. B. Farleigh," A first course in Abstract Algebra", Addison – Wesley Publication, 7th Edition, US, 2018.

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1. https://nptel.ac.in/courses/106/104/106104149
2. http://garsia.math.yorku.ca/~sdenton/algstruct
3. http://abstract.ups.edu/

A20MAT512	REAL ANALYSIS - I	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To understand the basics of real analysis theorems.
- To learn the concepts of convergent sequences and divergent Sequence.
- To identify the operations on convergent sequence operation on divergent sequence.
- To learn the concepts of convergent series.
- To understand the concepts of Continuous Functions On Metric Spaces.

Course Outcomes

At the end of the course students will be able to

CO1 – Acquire knowledge in solving problems based on real numbers.
CO2 – Recognize the sequence and convergence of sequences.
CO3 – Solve convergence or divergence sequence.
CO4 – Solve convergence or divergence series of real numbers.
CO5 – Understand the basic concepts of continuity of real functions, open and closed sets.

UNIT I FUNCTIONS (12 Hrs)

Functions – Real valued functions – Equivalence – Countability and Real numbers – Least Upper Bound.

UNIT II SEQUENCES (12 Hrs)

Definition – Subsequences – Limit of sequence – Convergent Sequence –Divergent Sequence – Bounded Sequence – Mono tone Sequence.

UNIT III SEQUENCES [CONTD] (12 Hrs)

Operations on Convergent Sequence Operation on Divergent Sequence – Limit Superior and Limit Inferior – Cauchy sequence series: Convergence and Divergence – Series with non-Negative terms Alternating series – Conditional Convergence and Absolute Convergence.

UNIT IV SERIES [CONTD] (12 Hrs)

Rearrangement of Series – Tests for Absolute Convergence – Series whose terms form a non-increasing Sequence – Summation of Parts. Limits and Metric spaces: Limit of an Function of the Real Line – Metric Spaces – Limits in Metric Spaces.

UNIT V CONTINUOUS FUNCTIONS ON METRIC SPACES (12 Hrs)

Functions Continuous at a point on the real line – Reformulation – Functions Continuous on a Metric Spaces – Open sets – Closed Sets.

Text Books

1. R. Goldberg, “Methods of Real Analysis”, Oxford & IBH Publishing Co., New Delhi,2000.
2. Bartle, R.G. and Shebert, “Real Analysis”, John Willy & Sons Inc., NewYork.1976.
3. Anthony W.Knapp “Advanced Real Analysis”, Birkhauser Boston Inc, U.S.A, 2005

Reference Books

1. Tom M. Aposto. “Mathematical Analysis”, Addison –Wesley,2nd Edition, New York,1974.
2. Malik, S.C and Savitha Arora, “Mathematical Analysis”, Willy Eastern Ltd, New Delhi,1991.
3. Sanjay Arora and BansiLal,”Introduction to Real Analysis”, Satya Prakashan, New Delhi, 1991.

Web References

1. http://cs.lewisu.edu/~harsyram/RealAnalysisIIWorkbookSp2020.pdf
2. https://www.jirka.org/ra/realanal2.pdf
3. https://www.mathcity.org/_media/atiq/sp19-mth322-review-riemann-sum.pdf

A20MAT513	COMPLEX ANALYSIS	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To learn the definition of analytic functions and understand their properties.
- To understand. Bilinear transformations and its properties.
- To study the basic contour integral.
- To understand Taylor's and Laurent's theorem.
- To apply their properties in the evaluation of definite integrals.

Course Outcomes

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

CO1 – Identify analytic function
CO2 – Analyze the effect of Bilinear Transformation on the complex plane.
CO3 – Evaluate complex integrals through residues
CO4 – Apply the concept of Taylor's and Laurent's theorem
CO5 – Understand the evolution of integral

UNIT I ANALYTIC FUNCTION (12 Hrs)

Analytic functions: Definitions of Function of a Complex Variable**–** Mappings- Limits, Continuity Derivatives and Differentiation Formula Cauchy-Riemann Equations **–** Properties of Analytic Functions **–** Necessary and Sufficient Conditions for Analytic Functions **–**Harmonic Functions **–** Determination of Harmonic Conjugate and Analytic Function.

UNIT II TRANSFORMATIONS (12 Hrs)

Conformal Mapping **–** Bilinear Transformations **–**Cross ratio – Fixed Points of Bilinear Transformations.

UNIT III CONTOUR INTEGRAL (12 Hrs)

Definite integral **–**Cauchy's Theorem **–** Cauchy's Integral Formula – Higher Derivatives.

UNIT IV TAYLOR'S AND LAURENT'S THEOREM (12 Hrs)

Taylor's Series **–** Laurent's Series **–** Zeros of Analytic Functions **–** Singularities.

UNIT VEVALUTION OF INTEGRAL (12 Hrs)

Cauchy's Residue theorem– Evaluation of integrals of the following types**–** $\int_0^{2\pi} f(cos\theta\ , sin\theta)\, d\theta, \int_{-\infty}^{\infty} f(x) sinax\ dx, \int_{-\infty}^{\infty} f(x)\ \cos ax\, dx\ , a > 0\ \ , \int_{-\infty}^{\infty} \frac{p(x)}{q(x)}\ dx, \int_{-\infty}^{\infty} f(x) dx$, where f(z) has finite number of poles on the real axes – Jordan's lemma(without proof)

Text Books

1. S.Arumugam, A.Thangapandi Isaac and A.Somasundaram, "Complex Analysis", SciTech Publications (India) Pvt.Ltd, 2015.
2. Ruel V. Churchill, James Ward Brown, "Complex Variables and Application", McGraw Hill Publishing Company, 9th Edition 2013.
3. L.V.Ahlfors, "Complex Analysis", 3rd edition, McGraw Hill, 2000.

Reference Books

1. S.Narayanan and T.K.Manickavasagam Pillai, "Complex Analysis", S.Viswanatha printers and publishers Pvt.Ltd., 2011.
2. P.Duraipandian, LaxmiDuraipandian, D.Muhilan, "Complex Analysis", Emerald publishers, Revised Edition, 2006.
3. Murray R.Spiegel, "Theory and Problems of Complex Variables", Schaum's Outline Series, McGraw Hill book Company, 2017.

Web References

1. https://math.mit.edu/~jorloff/18.04/notes/topic2.pdf
2. https://www.math.columbia.edu/~rf/complex2.pdf
3. https://math.mit.edu/~jorloff/18.04/notes/topic4.pdf

A20MAE507 **MACHINE LEARNING**

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To provide an introduction to the basic principles of Machine Learning
- To acquire the knowledge of linear models
- To understand the concepts of Tree and Probabilistic models
- To get formalized with Dimensionality reduction and Evolutionary models
- To expose the students to the basic of Graphical models

Course Outcomes

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

CO1 –Understand the basic conceptsand techniques of Machine Learning
CO2 –Apply the appropriate machine learning strategy for any given problem
CO3 –Improve their ability in the concept of probabilistic models
CO4 –Analyze and solve the component analysis and Genetic operators
CO5 –Attains knowledge of Networks and Graphical models

UNIT I INTRODUCTION (12 Hrs)

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II LINEAR MODELS (12 Hrs)

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi- layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back - Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT III TREE AND PROBABILISTIC MODELS (12 Hrs)

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods– Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

UNIT IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS (12 Hrs)

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.

UNIT V GRAPHICAL MODELS (12 Hrs)

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

Text Books

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.
2. Jason Bell, “Machine learning Hands on for Developers and Technical Professionals”, First Edition, Wiley, 2014.
3. EthemAlpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press, 2004.

Reference Books

1. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press, 2012.
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press, 2009.
3. Bishop, C,“Pattern Recognition and Machine Learning”. Berlin: Springer-Verlag,2006.

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1. http://www.cs.cmu.edu/tom/mlbook-chapter-slides.html
2. http://mleg.cse.sc.edu/edu/csce883/index.php?n=Main.LectureNotes
3. https://courses.cs.washington.edu/courses/cse446/14wi/

A20MAE508 **ARTIFICIAL INTELLIGENCE**

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

Course Outcomes

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

CO 1 – Use appropriate search algorithms for any AI problem.
CO 2 – Represent a problem using first order and predicate logic
CO 3 – Provide the apt agent strategy to solve a given problem
CO 4 – Design software agents to solve a problem.
CO 5 – Design applications for NLP that use Artificial Intelligence.

UNIT I INTRODUCTION (12 Hrs)

Introduction – Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS (12 Hrs)

Problem solving Methods – Search Strategies – Uninformed – Informed –Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning – Stochastic Games

UNIT III KNOWLEDGE REPRESENTATION (12 Hrs)

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining–Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information

UNIT IV SOFTWARE AGENTS (12 Hrs)

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS (12 Hrs)

AI applications – Language Models – Information Retrieval– Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving

Text Books

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.
2. I.Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

Reference Books

1. M. Tim Jones, ―Artificial Intelligence: A Systems Approach (Computer Science) ‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008.
2. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer. , 2003

Web References

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3. https://www.cpp.edu/~ftang/courses/CS420/notes/logical%20agent.pdf

A20CME523	INCOME TAX LAW & PRACTICE	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To gain knowledge in law pertaining to level of income tax in India.
- To Understand the concepts of computation of Income salary and house property.
- To Know the properties of profit and gains of business of profession.
- To learn the concepts of capital gain and Income of other sources
- To know about the other sources of income

Course Outcomes

After completing the course, the student shall be able to:

CO1 – Understand the basic concepts in the law of income tax.
CO2 – Find income under the head 'Salaries'
CO3 – Compute income under the head 'Income from House Property'.
CO4 – Analyze income under the head 'Profit and gains of business or profession'
CO5 – Compute income under the head 'Capital gains' and 'Income from other sources'

UNIT I INTRODUCTION (12 Hrs)

Income, agricultural income, person, assesse, assessment year, previous year, gross total income, total income, maximum marginal rate of tax; Permanent Account Number (PAN)

UNIT II INCOME FROM SALARY (12 Hrs)

Computation of Income from Salaries.

UNIT III INCOME FROM HOUSE PROPERTY (12 Hrs)

Computation of Income from house property

UNIT IV PROFIT AND GAINS OF BUSINESS OF PROFESSION (12 Hrs)

Computation of profits and gains of business or profession

UNIT V CAPITAL GAINS; INCOME FROM OTHER SOURCES (12 Hrs)

Computation of capital gains – Income from other sources.

Text Books

1. Dr. H.C. Mehrotra, Dr.S.P. Goyal, "Income Tax Law & Account", Sathiya Bhawan Publications, 61st Edition 2020.
2. Dr.R.K.Jain, "Income Tax Law and Pratice", SBPD Publication, 24th Edition 2017.
3. Singhania, K. Vinod and Monica Singhania, "Students' Guide to Income Tax", University Edition. Taxmann Publications Pvt. Ltd., 5th Edition 2021.

Reference Books

1. Ahuja, Girish and Ravi Gupta, "Systematic Approach to Income Tax, Bharat Law House, 14th Edition 2020.
2. Naveen Mittal, "Principles of Income Tax Law & Practice", Cengage India Publication, 2nd Edition 2021.
3. G.S.Mitra, "Income Tax: Law and Pratice", Mahaveer Publications, 2nd Edition 2020.

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2. onlinecourses.swayam2.ac.in
3. https://www.icsi.edu

A20MAS505	QUANTATIVE APTITUDE & REASONING – II	L	T	P	C	Hrs
		2	0	0	2	30

Course Objectives

- To enhance holistic development of students and improve their employability skills

Course Outcomes

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

CO1 – Improve aptitude, problem solving skills and reasoning ability.
CO2 – Qualify the written test of competitive exams, campus placements and PSUs.
CO3 – Equip the students with the skill based knowledge.
CO4 – Analyze and draw the graphs.
CO5 – Understand the various problem using given data.

UNIT I **(6 Hrs)**

Percentage – Profit or Loss – Discount

UNIT II **(6 Hrs)**

Ratio, proportion – Mixtures and Solutions

UNIT III **(6 Hrs)**

Time and work – Time, speed and distance, Problems related to train, Problems related to boats and streams

UNIT IV **(6 Hrs)**

Tabulation – Bar graphs & pie diagrams – Circle graphs

UNIT V **(6 Hrs)**

Data sufficiency – Data interpretation

Text Book

1. Dr.Agarwal. R.S, Quantitaive Aptitude for Competitive Examinations, S.Chand and Company Limited

Reference Book

1. Abhijit Guha, Quantative Aptitude for Competitive Examinations, Tata Mcgraw Hill, 3rd Edition.
2. Rapid Quantative Aptitude with shortcuts & Tricky for Competitive Exams – Disha publications.
3. Edgar Thrope, Test of Reasoning for Competitive Examinations, Tata Mcgraw Hill, 4th Edition

Web References

1. http://fw.freshersworld.com/placementweek/papers.asp
2. http://sawaal.com/aptitude-reasoning
3. http://pdf.exampundit.in

A20MAT614	LINEAR ALGEBRA	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To learn the Vector spaces and their Properties.
- To familiar about inner product spaces.
- To expose the operations on linear transformations.
- To understand transformations and their corresponding matrices.
- To introduce the concepts of Nilpotent Transformations.

Course Outcomes

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

CO1 – Test the linear independence and dependence of vectors.
CO2 – Apply the Gram Schmidt Orthogonalization process.
CO3 – Find the characteristic roots.
CO4 – Compute the linear transformations .
CO5 – Know the essential features of Nilpotent Transformations.

UNIT I VECTOR SPACES (12 Hrs)

Elementary Basic Concepts – Linear Dependence and Basis – Homomorphism (V, W) – dimension Homomorphism (V,W).

UNIT II INNER PRODUCT SPACES (12 Hrs)

Inner Product Spaces–Definition – Examples – Applications – Schwarz Inequality – Orthogonal Space – Gram Schmidt Orthogonalization process.

UNIT III LINEAR TRANSFORMATION (12 Hrs)

Linear Transformation – The Algebra of linear transformations – Characteristic Roots.

UNIT IV LINEAR TRANSFORMATION (CONTD) (12 Hrs)

Matrices–Canonical Forms: Triangular Forms.

UNIT V NILPOTENT TRANSFORMATION (12 Hrs)

Nilpotent Transformations – Definitions – Lemma – Theorems. Trace and Transpose – Definition – Properties – Theorems.

Text Books

1. I. N. Herstein, “Topics in Algebra”, Wiley India (P) Ltd., New Delhi,2nd Edition 2014.
2. N. S. Gopalakrishnan, “University Algebra”,New Age International (P) Ltd., 3rd Edition, 2015
3. Umed Singh Punia, Dr. J. S. Sikka, “Linear Algebra”, Jeevan sons Publications, 9th Edition, 2015.

Reference Books

1. Stephen H Friedberg, Arnold J Insel, Lawrence E. Spence, “Linear Algebra”, Pearson, 4thEdition, e-Book, 2013.
2. Peter Petersen, “Linear Algebra” (Undergraduate Texts in Mathematics),Springer, e-Book, 2012.
3. Gilbert Strang, “Introduction to Linear Algebra”, Wellesley Publishers, 5th Edition,2016.

Web References

1. https://www.khanacademy.org/math/linear-algebra
2. http://www.maths.qmul.ac.uk/~pjc/notes/linalg.pdf
3. http://home.iitk.ac.in/~arlal/MTH102/la.pdf

A20MAT615	REAL ANALYSIS - II	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To understand the concept of connected and bounded sets.
- To understand the concept of Complete Metric Space and Compact Metric Space.
- To expose the Operations on Riemann Integration.
- To learn the concept of Improper Riemann Integration.
- To understand the concepts of Taylor's Theorem.

Course Outcomes

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

CO1 – Describe open sets, connected sets and bounded sets

CO2 – Understand the difference between completeness and compactness of metric spaces

CO3 – Determine the Riemann integrability of a bounded function.

CO4 – Apply the mean value theorem and the Fundamental theorem of calculus.

CO5 – Apply Taylor's, Binomial theorem and L'Hospital rule.

UNIT I CONNECTEDNESS (12 Hrs)

More about Open Sets – Connected Sets –Bounded Sets and Totally Bounded Sets

UNIT II COMPLETENESS, COMPACTNESS (12 Hrs)

Complete Metric Space – Compact Metric Space – Continuous Functions on Compact Metric Spaces – Continuity of Inverse Functions

UNIT III RIEMANN INTEGRATION (12 Hrs)

Sets of measure zero- Definition of the Riemann Integral – Properties of the Riemann Integral – Derivatives – Rolle's Theorem

UNIT IV IMPROPER RIEMANN INTEGRATION (12 Hrs)

The Law of the Mean – Fundamental Theorem of Calculus – Improper Integrals– Cauchy's Principle Value.

UNIT V TAYLOR'S THEOREM (12 Hrs)

Taylor's Theorem: Taylor's Formula with Different Forms of Remainder – The Binomial Theorem - L' Hospital Rule

Text Books

1. R.Goldberg " Methods of Real Analysis", Oxford& IBH Publishing Co., NewDelhi, 2000.
2. Malik, S.C and Savitha Arora, "Mathematical Analysis", Willy Eastern Ltd, New Delhi,1991.
3. J.N.Sharma, A.R.Vasishtha, "Real Analysis",Krishna Prakashan Media(P) Ltd, 43rd Edition, 2014.

Reference Books

1. Tom M. Apostol. "Mathematical Analysis", Addison –Wesley,2nd Edition, New York,1974.
2. Sanjay Arora and BansiLal,"Introduction to Real Analysis", Satya Prakashan, New Delhi, 1991.
3. Bartle,R.G. and Shebert [1976] Real Analysis, John Willy & Sons Inc., NewYork, 1976

Web References

1. https://www.mathcity.org/_media/atiq/sp19-mth322-ch01.pdf
2. https://www.mathcity.org/_media/atiq/sp19-mth322-pre-ch02.pdf
3. https://www.mathcity.org/_media/atiq/sp19-mth322-ch02.pdf

A20MAT616	GRAPH THEORY	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To familiarize the concept of Graphs and subgraphs
- To learn the construction of adjacency matrix and incidence matrix
- To study the basic properties of connected graphs
- To know the Euler and Hamilton graphs
- To understand the concept of planar graphs.

Course Outcomes

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

CO1 – Identify the Isomorphism of graphs
CO2 – Apply the Basic rules of operations on graphs.
CO3 – Understand the basic concepts of connected graphs.
CO4 – Solve the problems related to Euler and Hamilton graphs.
CO5 – To know the applications of planar graphs

UNIT I GRAPHS AND SUBGRAPHS (12 Hrs)

Graphs, subgraphs, Degree of a vertex, Isomorphism of graphs, independent sets and coverings; intersection graphs.

UNIT II OPERATIONS ON GRAPHS (12 Hrs)

Adjacency and incidence of matrices; Operations on graphs; degree sequences; graphic sequences; Walks; trails; paths.

UNIT III CONNECTED GRAPHS (12 Hrs)

Connectedness and components; cut point, bridge, block; Connectivity theorems and simple problems.

UNIT IV EULER AND HAMILTON GRAPHS (12 Hrs)

Eulerian graphs and Hamiltonian graphs; simple problems; Trees, theorems, and simple problems.

UNITV PLANAR GRAPHS (12 Hrs)

Planarity; definition and properties; Characterisation of planar graph, Colour ability; chromatic number and index.

Text Books:

1. S.Arumugam and S.Ramachandran, “Invitation to Graph Theory”, SITECH Publications India Pvt. Ltd.,
2. J.A.Bondy and U.S.R. Murthy, Graph Theory with Applications, Macmillon, London.
3. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer Science & Business Media, 20-Sep-2012

Reference Books

1. S.Kumaravelu, SusheelaKumaravelu, Graph Theory, Publishers, 182, Chidambara Nagar, Nagercoil- 629 002.
2. S.A.Choudham, A First Course in Graph Theory, Macmillan India Ltd.
3. Robin J.Wilson, Introduction to Graph Theory, Longman Group Ltd.

Web References

1. https://en.wikipedia.org/wiki/Graph_theory
2. https://www.maths.ed.ac.uk/~v1ranick/papers/wilsongraph.pdf
3. https://www.tutorialspoint.com/graph_theory/graph_theory_introduction.htm

A20MAE607	FUZZY ALGEBRA	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To know the basic definitions of fuzzy set theory.
- To provide the fundamentals of fuzzy subsets
- To learn the applications of fuzzy logic
- To learn the concept of fuzzy subgroups
- To develop the concepts of fuzzy subrings

Course Outcomes

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

CO1 – Recognize the basic properties of fuzzy sets
CO2 – Understand the concepts of operations on fuzzy subsets
CO3 – Analyze and apply the concepts of fuzzy relations and logic
CO4 – Analyze the concepts of fuzzy subgroup
CO5 – Learn the concepts of fuzzy subrings.

UNIT I FUZZY SUBSETS AND FUZZY MAPPINGS (12 Hrs)

Introduction – Fuzzy subsets – Lattices and Boolean Algebras – L fuzzy sets – Operations on fuzzy – α level sets – Properties of fuzzy subsets of a set.

UNIT II OPERATIONS ON FUZZY SUBSETS (12 Hrs)

Algebraic product and sum of two fuzzy subsets – Properties satisfied by Addition and product– Cartesian product of fuzzy subsets.

UNIT III FUZZY RELATIONS AND FUZZY LOGIC (12 Hrs)

Introduction– Algebra of fuzzy relations – Logic – Connectives.

UNIT IV FUZZY SUBGROUP (12 Hrs)

Introduction – Fuzzy subgroup – Homomorphic image and preimage of sub groupoid.

UNIT V FUZZY SUBRINGS (12 Hrs)

Fuzzy invariant subgroups – Fuzzy sub rings.

Text Books

1. S.Nanda and N.R.Das, “Fuzzy Mathematical Concepts “, Narosa Publishing House, New Delhi,2020.
2. W.b. Vasanthakandasamy, “Fuzzy Algebra”, American Research Press, 2003.
3. Kwang H. Lee, “First Course on Fuzzy Theory and Applications”, Springer, New York, 2005.

Reference Books

1. H.J. Zimmerman, “Fuzzy Set Theory and its Application “, 3rd Ed., Springer India Pvt. Ltd., 2006.
2. M.Ganesh, “Introduction *to* Fuzzy Sets and Fuzzy Logic “, Prentice Hall of India Pvt. Ltd., 2006.
3. Sudhir K. Pundir, RimplePundir, “Fuzzy sets and their applications”,Pragati Prakash Publications, 2008.

Web References

1. http://www.narosa.com/books_display.asp?catgcode=978-81-8487-016-9
2. http://www.gallup.unm.edu/~smarandache/eBooks-otherformats.htm
3. https://www.springer.com/gp/book/9783790814200

A20MAE611	ASTRONOMY	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To introduce the concept Spherical Trigonometry
- To equip themselves familiar with Effects of Parallax
- Acquire the knowledge about the celestial sphere, solar system and stellar universe.
- Know about lunar eclipse and solar eclipse.
- Know about the positions of the stars and the constellations as seen from a given place, at a given time, on a given day.

Course Outcomes

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

CO1 – Understand the concept of Spherical Trigonometry
CO2 – Analyze and apply the knowledge of with Effects of Parallax
CO3 – Able to understand solar system and stellar universe.
CO4 – Understand the concept of eclipse and solar eclipse.
CO5 – To learn of the stars and the constellations as seen from a given place

UNIT I CELESTIAL BODIES (12 Hrs)

Spherical Trigonometry – Spherical Triangle – The fundamental formulae of Spherical Trigonometry, the sine, cosine, four parts and Napier formulae (without proof). The Celestial Sphere : Celestial coordinator – Diurnal Motion – Rising and setting of a star – Sidereal time – Circumpolar Star – Morning and Evening starts – Twilight – Earth – Length of the day.

UNIT II PARALLAX (12 Hrs)

Refraction – Tangent Formula Cassini's formula – Effects of Refraction – Geocentric Parallax – Effects of Geocentric Parallax – Heliocentric Parallax – Effects of Heliocentric Parallax – Aberration – Its Effects.

UNIT III SEASONS (12 Hrs)

Kepler's Laws – Verification of Kepler's Laws – True anomaly, Mean Anomaly – Eccentric Anomaly, Relation between them – Time – Equation of Time – Seasons – Conversion of Time.

UNIT IV MOON (12 Hrs)

Moon – Sidereal Month, Lunation and Relation between them – Phases of the Moon – Lunar Libration – Surface of the Moon – Metonic Cycle – Tides – Eclipses – Shadow Cone – Minimum and Maximum number of Eclipses.

UNIT V SOLAR SYSTEM (12 Hrs)

Planetary Phenomena – Bodes law – Elongation – Sidereal Period, Synodic period and the relation between them – Phase – Stationary Points – Solar System – Stellar Universe – A brief history of Astronomy – Astronomical Instruments.

Text Books

1. Andrew Franknoi, David Morrison and Sidney C.wolff ''Astronomy" press books on August 7,2019.
2. EricChaisson and Steve McMillan ''Astronomy: A Beginner's Guide'',Pearsons, Publication,7th Edition,2017.
3. Karttunen, H., Kröger, P., Oja, H., Poutanen, M., Donner, K.J. (Eds.) ''Fundamental Astronomy'' springer verlag berlin 2017

Reference Books

1. Jacqueline Mitton, David W. Hughes, Robert Dinwiddie, Penny Johnson Tom Jackson,"The Astronomy Book: Big Ideas Simply Explained'', September 5th 2017 by DK Publishing (Dorling Kindersley)
2. Astronomy for degree classes, Prof. S.Kumaravelu and Prof. Susheela Kumaravelu, Rainbow printers, Nagercoil (2005).
3. Karttunen, H., Kroger, P., Oja, H., Poutanen M and Donner, K.J ". Fundamental Astronomy'' Springer, 6th edition 2017

Web Resources

1. https://www.lonestar.edu/astronomy-web.htm
2. www.astronomynow.com
3. https://www.istl.org/02-spring/internet2.html

		L	T	P	C	Hrs
A20CME624	**FINANCIAL MANAGEMENT**	**3**	**1**	**0**	**4**	**60**

Course Objectives

- To study the various sources of finance
- To understand the various uses of Capitalbudgeting
- To familiarize the techniques used in financial leverage
- To know the financial working capital
- To acquire the knowledge of valuation of securities

Course Outcomes

At the end of the course students will be able to

CO1 – Define and recognize the concept of finance
CO2 – Attains the knowledge of uses of capital budgeting.
CO3 – Understand the usage of techniques in financial leverage
CO4 – Improve the ability in the concept of working capital
CO5 – Knowledge pertained to valuation of securities

UNIT I FINANCIAL MANAGEMENT (12 Hrs)

Meaning, Nature and Scope of Finance, Financial Goals, Profit Vs Wealth Maximization, Finance Function – Investment.

UNIT II CAPITAL BUDGETING (12 Hrs)

Nature of Investment Decisions; Investment evaluation criteria, Net Present Value, Internal Rate of Return, Profitability Index.

UNIT III FINANCIAL LEVERAGE (12 Hrs)

Measurement, Effects of Leverage on EPS, EBIT-EPS analysis, Indifference Point, Degree of Financial Leverage, Traditional Theory.

UNIT IV MANAGEMENT OF WORKING CAPITAL (12 Hrs)

Meaning, Significance, Types, Determinants, Calculating Operating Cycle period, Estimating working.

UNIT V VALUATION OF SECURITIES (12 Hrs)

Valuation concept, Equity Valuation, Discount models, The P/E ratio Approach, The relationship between Earnings- Price Ratio, dividend, Expected return and Growth .

Text books

1. Prasanna Chandra (2017),Financial Management: Theory and Practice, McGraw Hill Education; Ninth edition (1 July 2017)
2. Gupta P (2012),Financial Management, Vayu Education of India
3. Van Horne(2015),Fundamentals of Financial Management, Pearson Education, India

Reference books

1. Van Horne, James, C. (2001): Financial Management and Policy, Prentice Hall, Delhi.
2. Khan MY, Jain PK. (2002): Financial Management, Tata Mc Hill, New Delhi.
3. J Srinivasan, P Periasamy(2016),Fundamentals of Financial Management, Publisher: Vijay Nicole Imprints.

Web References

1. https://www.managementstudyguide.com/financial-management.htm
2. https://courses.lumenlearning.com/boundless-business/chapter/introduction-to-financial-management/
3. https://www.managementstudyguide.com/financial-management.htm

A20MAS606 **MATHEMATICAL MODELLING**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To achieve a broad understanding of the objectives of mathematical modelling
- To learn basic ideas to solve first order ordinary Differential Equations
- To construct mathematical models for real life problems.
- The know about use of mathematical models as a transferable process
- To provide several modelling techniques and analyze the resulting systems.

Course Outcomes

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

CO1 – Describe standard modelling procedures, which involve observations of a natural system using O.D.E
CO2 – Learn to use modelling in various fields using system of O.D.E
CO3 – Analyze and apply mathematical modelling for miscellaneous model
CO4 – Study mathematical modelling through Difference equation
CO5 – Analyze and draw modelling through Graphs

UNIT I MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER (9 Hrs)

Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems.

UNIT II MATHEMATICAL MODELLING THROUGH SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER (9 Hrs)

Population Dynamics – Epidemics – Compartment Models – Economics – Medicine, Arms Race, Battles and International Trade – Dynamics.

UNIT III MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS OF SECONDORDER (9 Hrs)

Planetary Motions – Circular Motion and Motion of Satellites –Mathematical Modelling through Linear Differential Equations of Second Order– Miscellaneous Mathematical Models.

UNIT IV MATHEMATICAL MODELLING THROUGH DIFFERENCE EQUATIONS (9 Hrs)

Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

UNIT V MATHEMATICAL MODELLING THROUGH GRAPHS (9 Hrs)

Solutions that can be Modelled Through Graphs – Mathematical Modelling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

Text Books

1. J.N. Kapur, Mathematical Modelling, Wiley Eastern Limited, New Delhi, 1988.
2. Seyes M.Moghada, Majid Jaberi-Douraki, “Mathematical Modeling”, wiley Publishers,2018.
3. Meerschart, Mathematical Modeling”, Elsevier 2013.

Reference Books

1. Arangala Crista,” Mathematical Modeling”, Taylor and Francis Inc., 2016
2. Haines.C,” Mathematical Modeling”, Elsevier Science & Tech., 2014
3. Mayer Humi, “ Introduction to Mathematical Modeling “, Chapman & Hall, 2018

Web References

1. https://staff.polito.it/marcello.delitala/dwd/mechanic_Simai.pdf
2. https://www.researchgate.net/publication/277986444_Lecture_Notes_on_Mathematical_Modelling_From _Applied_Sciences_to_Complex_Systems
3. http://www.math.utah.edu/~cherk/teach/5740MathModeling/12mathmodel/sources/Mathematical%20Modelling,%20Classroom%20Notes%20in%20Applied%20Mathematics%20(Murray%20S.%20Klamkin)%200898712041.pdf

A20MAT512	REVISED REAL ANALYSIS - I	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To understand the basics of real numbers and functions.
- To learn the concepts of convergent sequences and divergent Sequence.
- To identify the operations on convergent and divergent sequence.
- To learn the concepts of convergent series.
- To understand the concepts of Continuous Functions on Metric Spaces.

Course Outcomes

At the end of the course students will be able to

CO1 – Acquire knowledge in solving problems based on real numbers.
CO2 – Recognize the sequence and convergence of sequences.
CO3 – Identify convergence and divergence sequence.
CO4 – Solve convergence and divergence series of real numbers.
CO5 – Understand the basic concepts of continuity of real functions, open and closed sets.

UNIT I FUNCTIONS (12 Hrs)

Functions – Real valued functions – Equivalence – Countability and Real numbers – Least Upper Bound.

UNIT II SEQUENCES (12 Hrs)

Definition – Subsequences – Limit of sequence – Convergent Sequence –Divergent Sequence – Bounded Sequence – Monotonic Sequence.

UNIT III SEQUENCES [CONTD] (12 Hrs)

Operations on Convergent Sequence Operation on Divergent Sequence – Limit Superior and Limit Inferior – Cauchy sequence series: Convergence and Divergence – Series with non-Negative terms Alternating series – Conditional Convergence and Absolute Convergence.

UNIT IV SERIES [CONTD] (12 Hrs)

Rearrangement of Series – Tests for Absolute Convergence – Series whose terms form a non-increasing Sequence – Summation of Parts. Limits and Metric spaces: Limit of an Function of the Real Line – Metric Spaces – Limits in Metric Spaces.

UNIT V CONTINUOUS FUNCTIONS ON METRIC SPACES (12 Hrs)

Functions Continuous at a point on the real line – Reformulation – Functions Continuous on a Metric Spaces – Open sets – Closed Sets.

Text Books

1. R. Goldberg, “Methods of Real Analysis”, Oxford & IBH Publishing Co., New Delhi,2000.
2. Bartle, R.G. and Shebert, “Real Analysis”, John Willy & Sons Inc., NewYork.1976.
3. J.N.Sharma, A.R.Vasishtha, “Real Analysis”,Krishna Prakashan Media(P) Ltd, 43rd Edition, 2014.

Reference Books

1. Tom M. Apostol. “Mathematical Analysis”, Addison –Wesley,2nd Edition, New York,1974.
2. Malik, S.C and Savitha Arora, “Mathematical Analysis”, Willy Eastern Ltd, New Delhi,1991.
3. Sanjay Arora and BansiLal,”Introduction to Real Analysis”, Satya Prakashan, New Delhi, 1991.

Web References

1. http://cs.lewisu.edu/~harsyram/RealAnalysisIIWorkbookSp2020.pdf
2. https://www.jirka.org/ra/realanal2.pdf
3. https://www.mathcity.org/_media/atiq/sp19-mth322-review-riemann-sum.pdf
4.

REVISED

A20MAT513 **COMPLEX ANALYSIS**

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To learn the definition and properties of analytic functions.
- To understand Bilinear transformations and its properties.
- To study the basic contour integral.
- To understand Taylor's and Laurent's theorem.
- To know the evaluation of definite integrals.

Course Outcomes

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

CO1 – Identify analytic function
CO2 – Analyze the effect of Bilinear Transformation on the complex plane.
CO3 – Evaluate complex integrals using residues
CO4 – Apply the concept of Taylor's and Laurent's theorem
CO5 – Solve the Contour integral

UNITI ANALYTIC FUNCTION (12 Hrs)

Analytic functions: Definitions of Function of a Complex Variable**–** Mappings- Limits, Continuity Derivatives and Differentiation Formula Cauchy-Riemann Equations **–** Properties of Analytic Functions **–** Necessary and Sufficient Conditions for Analytic Functions **–**Harmonic Functions **–** Determination of Harmonic Conjugate.

UNIT II TRANSFORMATIONS (12 Hrs)

Conformal Mapping **–** Bilinear Transformations (sin Z, Cos Z, sinh Z, cosh Z, $\frac{1}{z}$, e^z, $Z+\frac{1}{z}$) -Cross ratio – Fixed Points of Bilinear Transformations.

UNIT IIICOMPLEX INTEGRATION (12 Hrs)

Definite integral **–** Cauchy's Theorem **–** Cauchy's Integral Formula – Higher Derivatives.

UNIT IVTAYLOR'S AND LAURENT'S THEOREM (12 Hrs)

Taylor's Series **–** Laurent's Series **–** Zeros of Analytic Functions **–** Singularities.

UNIT V CONTOUR INTEGRAL (12 Hrs)

Cauchy's Residue theorem – Evaluation of integrals of the following types**–** $\int_0^{2\pi} f(cos\theta\ , sin\theta)\, d\theta, \int_{-\infty}^{\infty} f(x) sinax\ dx, \int_{-\infty}^{\infty} f(x)\ \cos ax\, dx\ , a>0\ \ , \int_{-\infty}^{\infty} \frac{p(x)}{q(x)}\ dx, \int_{-\infty}^{\infty} f(x)dx$, where f(z) has finite number of poles on the real axes – Jordan's lemma(without proof)

Text Books

1. S.Narayanan and T.K.Manickavasagam Pillai, "Complex Analysis",S.Viswanatha printers and publishers Pvt.Ltd., 2011.
2. Ruel V. Churchill, James Ward Brown, "Complex Variables and Application", McGraw Hill Publishing Company, 9th Edition 2013.
3. S. Ponnusamy, "Foundations of Complex Analysis" Narosa Book Distributors, 2nd Edition, 2011.

Reference Books

1. S.Arumugam, A.Thangapandi Isaac and A.Somasundaram, "Complex Analysis", SciTech Publications (India) Pvt.Ltd, 2015
2. P.Duraipandian, Laxmi Duraipandian, D.Muhilan, "Complex Analysis", Emerald publishers, Revised Edition, 2006.
3. L.V.Ahlfors, "Complex Analysis", 3rd edition, McGraw Hill, 2000.

Web References

1. https://math.mit.edu/~jorloff/18.04/notes/topic2.pdf
2. https://www.math.columbia.edu/~rf/complex2.pdf
3. https://math.mit.edu/~jorloff/18.04/notes/topic4.pdf

REVISED

MACHINE LEARNING

L	T	P	C	Hrs
3	1	0	4	60

A20MAE505

Course Objectives

- To provide an introduction to the basic principles of Machine Learning
- To acquire the knowledge of linear models
- To understand the concepts of Tree and Probabilistic models
- To know about the Evolutionary models
- To learn the basic of Graphical models

Course Outcomes

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

CO1 – Understand the basic concepts and techniques of Machine Learning
CO2 – Apply the appropriate machine learning strategy for any given problem
CO3 – Improve their ability in the concept of probabilistic models
CO4 – Analyze and solve the component analysis and Genetic operators
CO5 – Attains knowledge of Networks and Graphical models

UNIT I INTRODUCTION (12 Hrs)

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search.

UNIT II LINEAR MODELS (12 Hrs)

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi- layer Perceptron in Practice – Examples of using the MLP.

UNIT III TREE AND PROBABILISTIC MODELS (12 Hrs)

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities .

UNIT IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS (12 Hrs)

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding .

UNIT V GRAPHICAL MODELS (12 Hrs)

Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

Text Books

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.
2. Jason Bell, “Machine learning Hands on for Developers and Technical Professionals”, First Edition, Wiley, 2014.
3. EthemAlpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press, 2004.

Reference Books

1. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press, 2012.
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press, 2009.
3. Bishop, C,“Pattern Recognition and Machine Learning”. Berlin: Springer-Verlag,2006.

Web References

1. http://www.cs.cmu.edu/tom/mlbook-chapter-slides.html
2. http://mleg.cse.sc.edu/edu/csce883/index.php?n=Main.LectureNotes
3. https://courses.cs.washington.edu/courses/cse446/14wi/

A20MAT616	REVISED GRAPH THEORY	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To familiarize the concept of Graphs and subgraphs
- To learn the construction of adjacency matrix and incidence matrix
- To study the basic properties of connected graphs
- To know the Euler and Hamilton graphs
- To understand the concept of planar graphs.

Course Outcomes

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

CO1 – Identify the Isomorphism of graphs
CO2 – Apply the Basic rules of operations on graphs.
CO3 – Understand the basic concepts of connected graphs.
CO4 – Solve the problems related to Euler and Hamilton graphs.
CO5 –To know the applications of planar graphs

UNIT I GRAPHS AND SUBGRAPHS (12 Hrs)

Graphs, subgraphs, Degree of a vertex, Isomorphism of graphs, independent sets and coverings; intersection graphs.

UNIT II OPERATIONS ON GRAPHS (12 Hrs)

Adjacency and incidence of matrices; Operations on graphs; degree sequences; graphic sequences; Walks; trails; paths.

UNIT III CONNECTED GRAPHS (12 Hrs)

Connectedness and components; cut point, bridge, block; Connectivity theorems and simple problems.

UNIT IV EULER AND HAMILTON GRAPHS (12 Hrs)

Eulerian graphs and Hamiltonian graphs; simple problems; Planar Graphs: Definition statement of four-color theorem

UNITV TREES (12 Hrs)

Trees, Properties, theorems, and simple problems.

Text Books:

1. S.Arumugam and S.Ramachandran, “Invitation to Graph Theory”, SITECH Publications India Pvt. Ltd.,
2. J.A.Bondy and U.S.R. Murthy, Graph Theory with Applications, Macmillon, London.
3. Narsingh Deo, “Graph Theory with Applications to Engineering & Computer Science, Dover Publications, Inc. 2016

Reference Books

1. S.Kumaravelu, Susheela Kumaravelu, Graph Theory, Publishers, 182, Chidambara Nagar, Nagercoil- 629 002.
2. S.A.Choudham, A First Course in Graph Theory, Macmillan India Ltd.
3. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer Science & Business Media, 20-Sep-2012

Web References

1. https://en.wikipedia.org/wiki/Graph_theory
2. https://www.maths.ed.ac.uk/~v1ranick/papers/wilsongraph.pdf
3. https://www.tutorialspoint.com/graph_theory/graph_theory_introduction.htm

ANNEXURE III

	REVISED	L	T	P	C	Hrs
A20MAE506	**ARTIFICIAL INTELLIGENCE**	**3**	**1**	**0**	**4**	**60**

Course Objectives

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To gain knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

Course Outcomes

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

CO1 – Use appropriate search algorithms for any AI problem.
CO2 – Represent a problem using first order and predicate logic
CO3 – Provide the apt agent strategy to solve a given problem
CO4 – Design software agents to solve a problem.
CO5 – Design applications for NLP.

UNIT I INTRODUCTION (12 Hrs)

Introduction – Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS (12 Hrs)

Problem solving Methods – Search Strategies– Uninformed – Informed –Heuristics –Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking .

UNIT III KNOWLEDGE REPRESENTATION (12 Hrs)

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining–Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects .

UNIT IV SOFTWARE AGENTS (12 Hrs)

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS (12 Hrs)

AI applications – Language Models – Information Retrieval– Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving

Text Books

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.
2. I.Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

Reference Books

1. M. Tim Jones, Artificial Intelligence: A Systems Approach (Computer Science) ‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖,Fifth Edition, Springer. , 2003

Web References

1. https://pdf.co/blog/problem-solving-techniques-in-artificial-intelligence-ai
2. https://nptel.ac.in/courses/106/102/106102220/
3. https://www.cpp.edu/~ftang/courses/CS420/notes/logical%20agent.pdf

A20MAE608	REVISED	L	T	P	C	Hrs
	ASTRONOMY	3	1	0	4	60

Course Objectives

- To introduce the concept Spherical Trigonometry
- To learn about Effects of Parallax
- To Acquire the knowledge about the celestial sphere, solar system and stellar universe.
- To Know about lunar eclipse and solar eclipse.
- Know about the positions of the stars

Course Outcomes

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

CO1 – Understand the concept of Spherical Trigonometry
CO2 – Analyze and apply the knowledge about Effects of Parallax
CO3 – Able to understand solar system and stellar universe.
CO4 – Understand the concept of eclipse and solar eclipse.
CO5 –To learn of the stars and the constellations as seen from a given place

UNIT I **(12 Hrs)**

Spherical Trigonometry - Spherical Triangle - The fundamental formulae of Spherical Trigonometry, the sine, cosine, four parts and Napier formulae (without proof). The Celestial Sphere : Celestial coordinator.

UNIT II **(12 Hrs)**

Refraction - Tangent Formula Cassini's formula - Effects of Refraction - Geocentric Parallax - Effects of Geocentric Parallax - Heliocentric Parallax - Effects of Heliocentric Parallax - Aberration - Its Effects.

UNIT III **(12 Hrs)**

Kepler's Laws - Verification of Kepler's Laws - True anomaly, Mean Anomaly- Eccentric Anomaly, Relation between them - Time - Equation of Time - Seasons - Conversion of Time.

UNIT IV **(12 Hrs)**

Moon - Sidereal Month, Lunation and Relation between them - Phases of the Moon - Lunar Libration - Surface of the Moon - Metonic Cycle – Tides.

UNIT V **(12 Hrs)**

Planetary Phenomena - Bodes law - Elongation - Sidereal Period, Synodic period and the relation between them - Phase - Stationary Points - Solar System.

Text Books

1. Andrew Franknoi, David Morrison and Sidney C.wolff ''Astronomy" pressbooks on August 7,2019.
2. EricChaisson and Steve McMillan ''Astronomy: A Beginner's Guide'',Pearsons, Publication,7th Edition,2017.
3. Karttunen, H., Kröger, P., Oja, H., Poutanen, M., Donner, K.J. (Eds.) ''Fundamental Astronomy'' springer verlag berlin 2017

Reference Books

1. Jacqueline Mitton, David W. Hughes, Robert Dinwiddie, Penny Johnson Tom Jackson, ”The Astronomy Book: Big Ideas Simply Explained’’, September 5th 2017 by DK Publishing (Dorling Kindersley)
2. Astronomy for degree classes, Prof. S.Kumaravelu and Prof. Susheela Kumaravelu, Rainbow printers, Nagercoil (2005).
3. Karttunen, H., Kroger, P., Oja, H., Poutanen M and Donner, K.J “. Fundamental Astronomy’’ Springer, 6th edition 2017

Web Resources

1. https://www.lonestar.edu/astronomy-web.htm
2. www.astronomynow.com
3. https://www.istl.org/02-spring/internet2.html