SHSB1102	GENERAL ENGLISH I	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To provide opportunities for students to read and respond to representations of current issues
- To prepare the students to effectively communicate by applying reflective thinking practices
- To provide an opportunity to the students to improve their vocabulary
- To create and apply lateral and critical thinking
- To learn academic writing strategies

UNIT I **9 Hrs**

Listening to identify vocabularies- Self Introduction - Developing dialogue between characters-Talking about neighbours, family members, likes and dislikes, Reading Comprehension strategies- Parts of Speech- Kinds of Sentences Connectives and Discourse markers - Rearranging the Jumbled sentences, E-Mail Writing.

UNIT II **9 Hrs**

Listening for Inference- Just a Minute speech- Types of words- Compound words, abbreviations and acronyms, Word Association-Tenses and its Types- Voice- Impersonal Passive- Rules of Passive voice formation- Transcoding - Encoding and Decoding- Bar chart, Pie Chart

UNIT III **9 Hrs**

Listening to telephonic talk to fill blanks- Giving information- travel, hotel booking, making enquiries about availability of seats for admission, asking about courses - Question Tags – Open ended and Close ended questions, Concord, Single - Line Definition - Note Making - Preparing checklists

UNIT IV **9 Hrs**

Listening to summarise the information- Reading and identifying the topic sentence, - Editing - Punctuation- Error Corrections, 'If 'Conditionals, Idioms & Phrases, Instructions Recommendations –Drafting a brochure/Advertisement.

UNIT V **9 Hrs**

Listening to Movie reviews and book reviews, Listening and summarizing- Giving impromptu talks- Reading and Summarizing -Types of words- Homonyms, Homophones, eponyms, acronyms- Writing a Paragraph, Descriptive Essay, Dialogue Writing.

Max Hrs: 45 Hrs

On the completion of the course, the student will be able to

CO1 Remember knowledge of linking words related to both spoken and written discourse

CO2 Understand collocations, words to express one's point of view in both writing and speaking

CO3 Apply the rules for writing compare and contrast paragraphs by using cohesive devices based on prompts given

CO4 Analyse critical thinking skills by framing questions related to elements of reasoning

CO5 Evaluate written pieces to self-correct in the topic areas of verbs, reported speech, and punctuation

CO6 Equip the students with the required Professional Skills

TEXT BOOKS

1. Sen S, Mahendraetal. (2015) Communication and Language Skills. Foundation books. Chennai.

REFERENCE BOOKS

1. Strunk, William Jr., and E.B. White. The Elements of Style. Allyn and Bacon, 2000.
2. Murphy, Raymond. English Grammar in Use. Cambridge University Press, 2012.
3. Thomson, A.J., and A.V. Martinet. A Practical English Grammar. Oxford University Press, 1986.
4. Straus, Jane. The Blue Book of Grammar and Punctuation. John Wiley & Sons, 2014.
5. O'Conner, Patricia T. Woe is I: The Grammarphobe's Guide to Better English in Plain English. Riverhead Books, 2019.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1104	CALCULUS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To provide core concepts of calculus are derivatives and integrals.
- To provide the knowledge and the ability to work with these concepts are essential for future studies of mathematical subjects and applications of mathematical techniques in other sciences.
- To enable the students on understanding calculus concepts, analyze, interpret and communicate the results clearly.

UNIT I DIFFERENTIAL CALCULUS **12 Hrs**

Successive differentiation Leibnitz's theorem (Without proof) and its application **-** Subtangent and Subnormal – Polar coordinates – Angle between the radius vector and tangent – Slope of the tangent – Angle between two curves – Polar sub tangent and Polar subnormal – Length of an arc.

UNIT II DIFFERENTIAL CALCULUS (CONTD…) **12 Hrs**

Curvature - Radius of curvature in Cartesian and Polar co-ordinates, Centre of curvature and Circle of curvature - Evolutes and Envelopes – definition - Method of finding envelopes - Problems in all sections.

UNIT III MULTIVARIABLE CALCULUS **12 Hrs**

Continuity and differentiability of a function of two and three variables – Taylor's theorem and Expansion of functions of two variables - Total differential - Jacobians - Maxima and minima of functions of two independent variables, Lagrange's multiplier method (without proof), problems on this concept.

UNIT IV INTEGRAL CALCULUS **12 Hrs**

Integration - Bernoulli's formula - Definite Integrals and their properties- Reduction Formulae for $\sin^n x$, $\cos^n x$, $\tan^n x$,$\cot^n x$, $\sec^n x$, $\operatorname{cosec}^n x$, , $\sin^m x.\cos^n x$, $x^n e^{ax}$, $x^m (\log x)^n$ - Problems for all the above cases.

UNIT V MULTIPLE INTEGRALS **12 Hrs**

Double Integrals - Change of order of Integration - Triple Integrals - Applications to Area, Surface Area and Volume (Simple problems).

Max Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Identify the region in change of order of integration. Recognize the parametric form of curves, derivatives and integrals of functions.

CO2 Explain the applications of double and triple integrals, applications of Leibnitz theorem.

CO3 Apply partial derivates in Jacobians, Taylor's series and total differentiations.

CO4 Compare the changes in order of integration, compare the slope, normal and tangents in polar form.

CO5 Evaluate definite integrals using properties. Evaluate circle of curvature, Evolutes and Envelopes of given curves. Appraise the maxima and minima of multivariable functions.

CO6 Develope the concept of area, surface area & volume integrals in different engineering problems, Formulate the reduction formula to trigonometric and other functions.

TEXT / REFERENCE BOOKS

1. Narayanan. S, ManicavachagomPillay. T.K. Calculus, S.Viswanathan (Printers and Publishers), 2006.

2. S. Arumugam, A.T. Issac, Calculus, New Gamma Publications, Revised Edition, 2011.

3. DipakChatterjee,IntegralCalculusanddifferentialequations,TATAMcGrawS Hill Publishing Company Ltd.,2000.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**

PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SPHB1103	ANCILLARY PHYSICS I	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

- This course would empower the student to acquire engineering skills and practical knowledge. It helps the students in their everyday life.
- This syllabus will provide the basic requirements for their higher studies and also provide a theoretical basis for doing experiments in related areas..

UNIT I GRAVITATION **9 Hrs**

Newton's law of Gravitation- Mass and density of earth – Determination of G (Boy‟s method) – The universal law of gravitation- Acceleration due to gravity and its variation with altitude and depth - Determination of g by compound pendulum.Gravitational potential energy; gravitational potential -Gravitational field and potential at a point inside and outside a spherical shell –Kepler's laws of planetary motion- -Escape velocity- Orbital velocity of a satellite; Geo-stationary satellites

UNIT II ELASTICITY **9 Hrs**

Elasticity – Stress, strain – Poisson‟s ratio –Hooke‟s law –Moduli of elasticity – Young‟s modulus, Bulk modulus, rigidity modulus –Relation between elastic constants – Determination of Poisson‟s ratio – Torsional Pendulum – Determination of Coefficient of Rigidity for a wire-Bending of a beam – Bending moment – Uniform and Non uniform Bending-Expression for bending moment – Cantilever – Expression for depression – Experiment to find Young‟s Modulus

UNIT III HEAT AND THERMODYNAMICS **9 Hrs**

Heat: Specific heat - Callender'sBarne's method to determine the specific heat of a liquid-Newton's law of cooling - determination of specific heat of a liquid using Newton's law of cooling - Emissivity and Emissive power. Low Temperature: J.K. Effect - Positive effect - Negative effect - Temperature of inversion - liquefaction of air Linde's method Thermodynamic systems (closed and open); thermodynamic properties and equilibrium; state postulate for simple compressible substances, state diagrams, paths and processes on state diagrams; concepts of heat and work, zeroth law-first and second of thermodynamics

UNIT IV OSCILLATIONS AND WAVES **9 Hrs**

Periodic motion - period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M.) and its equation; phase; oscillations of a spring -restoring force and force constant; energy in S.H.M. - kinetic and potential energies; Simple pendulum - derivation of expression for its time period; Free, forced and damped oscillations (qualitative), resonance - Wave motion. Longitudinal and transverse waves, speed of a wave. Principle of superposition of waves, reflection of waves, Standing waves in strings, fundamental mode and harmonics, Beats, Doppler effect in sound.

UNIT V OPTICS **9 Hrs**

Introduction to Optics- Reflection, Refraction and Total internal reflection- Lens and its types-Principal axis, Optical centre, Principal focus, Focal length and the power of lens-Aberration- Types of aberration (qualitative) - Spherical aberration - Chromatic aberration in lenses - Interference - Air Wedge - description - Determination of diameter of a thin wire by air wedge Diffraction: Theory of transmission grating - Determination of Wavelength of monochromatic source and Wavelength of mercury lines using a grating by normal Incidence.

Max Hrs: 45 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Acquire knowledge of classical physics
CO2 Understand about elasticity
CO3 An exposure to thermal physics
CO4 A detailed knowledge about waves, vibration
CO5 An idea of optical and phenomenon associated with it
CO6 Analyze the wavelength of monochromatic source using a grating by normal incidence.

TEXT / REFERENCE BOOKS

1. Allied Physics - R. Murugesan S. Chand & Co. First Edition (2005)
2. Allied Physics - Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
3. Allied Physics - Prof. Dhanalakshmi and others.
4. Elements of Properties of Matter - D.S Mathur, S. Chand & Co. (1999).
5. Heat and Thermodynamics - N. Brijlal and Subramaniam S. Chand & Co.
6. A text book of Sound - by M. Narayanamoorthy and other National Publishing companies (1986).

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SPHB2104	ANCILLARY PHYSICS LAB I	L	T	P	EL	C
		0	0	4	0	2

COURSE OBJECTIVES:

- To make the students to understand a broad range of experimental techniques
- To demonstrate their ability to use the techniques in conducting scientific experiments and observations

LIST OF EXPERIMENTS

1. Youngs modulus of a bar - cantilever - bending - pin and microscope.
2. Youngs modulus of a bar - cantilever - bending - optic lever.
3. Rigidity modulus of a wire-Torsion pendulum.
4. Determine the value of g and K using Compound Bar Pendulum.
5. Determine the coefficient of thermal conductivity of a bad conductor by Lee 's disc method.
6. Demonstration of Newton's law of cooling.
7. Determine the mass of a substance by sonometer
8. To study refraction of light by prism using a spectrometer

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class Model practical exam	25 Marks 25 Marks	50 Marks
ESE	University Practical exam		50 Marks

SHSB1201	GENERAL ENGLISH II	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To provide opportunities for students to read and respond to representations of current issues through texts that present themes and topics that are familiar, insightful and informative.
- To provide an opportunity to the students to improve their vocabulary
- To develop skills relating to creative writing.
- To provide an opportunity to the students to improve their Spoken Language.
- To comprehend the overall idea of a written and oral context.

UNIT I **9 Hrs**

Listening for details, Speaking - making a presentation, reading for details and Global Comprehension Vocabulary Binomials, Types of Words- Synonyms, Antonyms that describe people, things and their actions - Paired Expressions-Letter Writing - Informal Letters- Letter to a Friend / Family Members - Creating blogs to post written materials.

UNIT II **9 Hrs**

Listening for details - Speaking: Giving Interview, Public Speech based on specific topics given. Reading for Comprehension and for overall idea -Vocabulary: phrases- Sentence Pattern – Contextual guessing of words– Singular, Plural– Letter writing- Formal letters- Inviting dignitary for a function, Application for job with resume.

UNIT III **9 Hrs**

Listening for details - Telephonic conversation –Speaking: Narrating a Story - Vocabulary: positive and negative connotations - Language Focus: Adjective- Degrees of Comparison, Direct and Indirect Speech - Types of Sentences (simple, compound, complex) -Collocations-Letter to the Editor (Social Issues) – Hints Development.

UNIT IV **9 Hrs**

Listening for Overall information - Making requests and suggestions - Speaking: Group Discussion - Vocabulary: Homonyms and Homophones- Language Focus: Transitive and Intransitive verbs - Writing: Precis writing, Story Writing - Process description (Flowchart)

UNIT V **9 Hrs**

Listening for specific details - Speaking using imagination. Reading to identify facts - Language focus: Modal Auxiliary VerbsWriting: Imaginative writing by predicting, Argumentative Essay, Writing a Book or Film review. Vocabulary: Countable and Uncountable Nouns, foreign nouns and framing of plurals.

Max Hrs: 45 Hrs

At the end of the course the students will be able to:

CO1 Remember knowledge of linking words related to both spoken and written discourse
CO2 Understand collocations, words to express one's point of view in both writing and speaking
CO3 Apply the rules for writing compare and contrast paragraphs by using cohesive devices based on prompts given
CO4 Analyse critical thinking skills by framing questions related to elements of reasoning
CO5 Evaluate written pieces to self-correct in the topic areas of verbs, reported speech, and punctuation
CO6 Equip the students with the required Professional Skills

TEXT / REFERENCE:

1. Sen S, Mahendraetal. (2015) Communication and Language Skills. Foundation books. Chennai

REFERENCES BOOKS

1. Strunk Jr., William, and E.B. White. The Elements of Style. Allyn and Bacon, 2000.
2. Murphy, Raymond. English Grammar in Use. Cambridge University Press, 2019.
3. Thomson, A.J., and A.V. Martinet. A Practical English Grammar. Oxford University Press, 2013.
4. Straus, Jane. The Blue Book of Grammar and Punctuation. John Wiley & Sons, 2014.
5. Swan, Michael. Practical English Usage. Oxford University Press, 2016.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1204	SEQUENCE AND SERIES	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To understand the basic definitions of limits and convergence in the context of sequences and series of real numbers.
- To provide the limits of sequences involving elementary functions by applying Cauchy's test D Alembert's test Raabe's test
- To help students to understand and organize the material they have learned as well as to solve problems

UNIT I SEQUENCES **12 Hrs**

Sequence-Limit, Convergence of a sequence- Cauchy's general principle of convergence Cauchy's first theorem on Limits-Bounded sequences – Divergent and Oscillating Sequence.

UNIT LIMIT OF THE SEQUENCE **12 Hrs**

Behavior of monotonic sequence – finite or infinite Sequence- Limit superior and Limit inferior -Some theorems on limits and Problems.

UNIT III INFINITE SERIES **12 Hrs**

Infinite series - Definition of Convergence, Divergence & Oscillation Series – Necessary condition for convergence –Convergence of Geometric series-Exponential & Logarithmic series –Summation of Series &Approximations using these theorems.

UNIT IV TESTING OF SERIES-I **12 Hrs**

Testing the convergence and divergence of series using Comparison test -D„Alembert's ratio test- Raabe's test and Leibnitz's Test with simple problems.

UNIT V TESTING OF SERIES-II **12Hrs**

Testing of series to obtain the convergence and divergence using Cauchy's condensation Test-Cauchy's root test and their simple problems- Alternative series with simple problems.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Identify finite and infinite of a sequence. Recognize to test infinite series for convergence. Understand the concept of convergence
CO2 Explain the method of testing for the convergence of an infinite series
CO3 Apply Comparison test to determine whether a series converges or not
CO4 Investigate D.Alembert's ratio test and Raabe's test to test the convergence of the series
CO5 Evaluate sum to infinity for an infinite series
CO6 Evaluate by Cauchy's root test for the convergence of the series along with alternating series

TEXT /REFERENCESBOOK

1. T.K. ManicavachagamPillai, T. Natarajan, K.S. Ganapathy, , Vol. I, S. Viswanathan Pvt Limited, Chennai, 2004.
2. M.K.Singal&Asha Rani Singal, A first course in Real Analysis, R. Chand & Co. 1999.
3. Dr.S.Arumugam, Sequences & Series, New Gamma Publishers, 1999.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1205	THEORY OF EQUATIONS AND MATRICES	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- This course enables the student to learn to solve systems of linear equations and application problems requiring them.
- To provide the use of eigen values and eigen vectors of a matrix and to work with matrices
- To determine if a given square matrix is invertible

UNIT I THEORY OF EQUATIONS **12 Hrs**

Polynomial equations – Imaginary and Irrational roots – relation between roots and coefficients of equations – Symmetric functions of roots in terms of coefficients of third degree equation - problems.

UNIT II RECIPROCAL EQUATIONS **12 Hrs**

Sum of the powers of the roots of an equation – Newton's Theorem on the sum of the powers of the roots – Transformation of equations – Roots with sign changed – Roots multiplied by a given number – Reciprocal equations – problems.

UNIT III TRANSFORMATION OF EQUATIONS **12 Hrs**

Increase or decrease the roots of a given equation by a given quantity. Removal of terms - Square of the roots – Transformations in general – Descarte's rule of signs – problems.

UNIT IV ELEMENTATARY CONCEPTS **12 Hrs**

Symmetric and skew-symmetric matrices, Hermitian and skew-Hermitian matrices, Orthogonal and unitary matrices, Triangular and diagonal matrices, Rank of a matrix, Elementary transformations, Echelon and normal forms, Inverse of a matrix by elementary transformations.

UNIT V MATRICES **12 Hrs**

Characteristic equation, Eigen values and Eigen vectors of a matrix, Clayey- Hamilton's theorem and its use in finding inverse of a matrix, Application of matrices to solve a system of linear (both homogeneous and non-homogeneous) equations, Consistency and general solution, Diagonalization of square matrices with distinct Eigen values, Quadratic forms.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to

CO1 Identify the nature of roots by Descarte's rules and quadratic forms..
CO2 Understand the relations between roots and coefficients of equations.
CO3 Choose appropriate method and solve the reciprocal equations.
CO4 Analyze the Echelon and normal forms in matrices.
CO5 Evaluate rank and inverse of matrices by elementary transformations.
CO6 Construct the diagonal matrix by transformations.

TEXT / REFERENCE BOOKS

1. T. K. Manickavasagam Pillai, Natarajan and Ganapathy, Algebra, Volume II, S.ViswanathanPvt. Ltd., 2004.
2. T.K.Manickavachagam Pillai, Matrices, S.Viswanathan Printers & Publishers, 2012.
3. S. Sudha, Algebra, Analytical Geometry (2D) and Trigonometry, Emerald publishers, 1998.
4. A. Singaravelu, Algebra & Trigonometry, Vol. I & II, Meenakshi Agency, 2003.

ND SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SBSB2102	BASIC COMPUTING LAB	L	T	P	EL	C
		0	0	4	0	2

COURSE OBJECTIVES:

- This module aims to introduce students to some of the key concepts of computer technologies in order to highlight the importance and power of abstraction within Computer Science.
- Students will also be introduced to computer hardware systems

Aim:

- Equip students with the fundamental knowledge of computer technologies.
- Provide an understanding of the role of computation can play in solving problems.
- Develop the student's understanding of the basic concepts of computer oriented programming and how to test their programs in using an integrated approach.
- Engage learning core concepts through a hands-on practical approach to enable students to apply their skills to different scenarios.

a. Word Processing

1. Change the layout of the page as given

   below. Page size:A4 (8.27" x 11.69")

   Page orientation: Landscape
2. Change the page margins as follows:

   Top: 1.25" Bottom: 1.25"

   Right: 1.25 Left: 1.25"
3. Create drop cap for first paragraph. Drop it 2 lines down with 'Algerian' font and there should be 0.4" space between dropped character and paragraph.
4. Present second paragraph in three columns with a line between each columns. The first and third columns will be 1" wide and the second column is 4"
5. Apply graycolor background and double line border around third paragraph. Border line should be of blue color and 1½ thick.
6. Justify third paragraph and apply 2" indent from left and right.
7. Enter "History of Computer Technology" as header and enter footnote for the underlined word of third paragraph.
8. Create a custom watermark, cross referencing in word, a user entry forms
9. Create a main document for the invitation of a birth day party.

b. Spreadsheet

1. Create an Excel Formula for the given string format using String Functions. Input: I Love India

   Output: India 5
2. In a Table, we have students name and their Marks in Science, social & maths subjects. Find the top student in each subject based on their mark (using Excel Formula)

Name	Subject	Marks
Raja	Science	75
Bala	Maths	45
Umar	Social	57
Raja	Maths	87
…		

3. Count the total number of occurrences of "A" in the following table using Excel Formula – (Should be Generic)
4. Create a Formula to count the cells that having values except blank cells
5. Create a Formula to calculate the EB bill with the given
   tariff 1 – 100 : Ps. 75

   101 – 200 : Rs. 1.10
   201 - 300 : Rs. 2.00
   301 – 500 : Rs. 3.00
   501 & above : Rs.5.00
6. Create a formula to calculate the classification of result
   a. Below 40 : Fail
   b. 40 – 50 : 3rd Class
   c. 51-60 : 2nd Class
   d. 61 – 70: 1st class
   e. Above 70: Distinction
7. With the given chart,

	A	B	C	D	E
1	Master List				
2	Sales Person ID	Sales Person Name	Sales Person Revenue	Quota	Met Quota?
3	1	John	$ 232,103.00	$ 500,000.00	Did Not Meet Quota
4	2	Joe	$ 835,477.00	$ 500,000.00	Met Quota
5	3	Jen	$ 116,371.00	$ 500,000.00	Did Not Meet Quota
6	4	Frank	$ 393,841.00	$ 500,000.00	Did Not Meet Quota
7	5	Mark	$ 989,303.00	$ 500,000.00	Met Quota
8	6	Amanda	$ 641,883.00	$ 500,000.00	Met Quota
9	7	Erik	$ 525,894.00	$ 500,000.00	Met Quota
10	8	Mike	$ 732,195.00	$ 500,000.00	Met Quota
11	9	Matt	$ 513,372.00	$ 500,000.00	Met Quota
12	10	Josh	$ 961,561.00	$ 500,000.00	Met Quota
13	11	Shea	$ 235,652.00	$ 500,000.00	Did Not Meet Quota

Find the average of Sales person revenue who are all met the quota and who are all not met.

8. From the given table,

Forename	Middle Name 1	Middle Name 2	Surname
Raja	Ravi	Chandar	Dilak

Print the Full name using excel formula

9. Convert float values into integer values
10. Find the factorial of given
    value 11.

SESSION_ NO	ROUND1	ROUND2	ROUND3	TOTAL/ 300	PERCENTAGE	GRADE
SS1	56	46	65			
SS2	78	56	67			
SS3	98	85	81			
SS4	71	77	68			

Criteria to find GRADE

PERCENTAGE >= 80 ---------- GRADE – A
PERCENTAGE between 79 and 60 (both are inclusive) ---------- GRADE – B
PERCENTAGE between 59 and 50 (both are inclusive) ---------- GRADE – C

Otherwise ---------- GRADE – F

(a) Find out TOTAL and PERCENTAGE of all sessions using function or formula. (1)

(b) Find out GRADE using above specified criteria of all sessions. (1)

(c) Using SESSION_NO and PERCENTAGE create a line chart. (2)12.

AAAA College								
Mark Sheet								
ID.No	Name	Physics	Chemistry	Biology	English	Total	Average	Rank
1A001	Lavanya	72	65	57	82			
1A002	Rithika	78	64	54	56			
1A003	Ram	56	63	72	54			
1A004	Ritesh	46	48	64	52			
1A005	Pranesh	48	65	56	65			
1A006	Pavithra	57	53	63	62			
1A007	Sara	65	54	53	51			

a. Use the relevant formula to calculate the total marks of “Lavanya” (ID No. 1A001) and copy the formula to the relevant cells.
b. Use the relevant formula to calculate the average marks of “Lavanya” (ID No.1A001) and copy the formula to the relevant cells.
c. Use conditional formatting to change the color of the cells of which the average mark is more than 60, in to green
d. Create a Pie chart for the student marks in the given table

c. Presentation Tool

1. Add notes to power point presentation
2. Create a power point application to Play a video
   a. Play a video full screen
   b. Hide a video when not playing
   c. Loop a video
3. Create a dynamic presentation in Power point
   a. To add animation to text or an object
   b. Apply sound effects to animated text and objects
   c. Create a motion path to text and objects
4. Creation of PowerPoint presentation about “Computer generation”.
5. Create maximum 5 slides (1)
6. Use different layouts and background design.(1)
7. Add bulleted list with animation effects.(1)
8. Set different slide transition effects. (1)

d. Usage of Google tools in education

Google docs
Google Forms
Google Spread sheets
Google

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SMTB1305	ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- This course enables to evaluate first order differential equations including separable, homogeneous,exact and linear, existence and uniqueness of solutions.
- To solve second order and higher order linear differential equations.
- To provide the knowledge of partial differential equations and to solve second and higher order Partial Differential with different methods.

UNIT I DIFFERENTIAL EQUATIONS OF FIRST ORDER 12 Hrs

Elementary Methods in Ordinary Differential Equations - Formation of differential equation - Solutions: General, particular, and singular - First order exact equations and integrating factors - Degree and order of a differential equation - Equations of first order and first degree - Equations in which the variable are separable - Homogeneous equations - First order higher degree equations solvable for x, y, p - Clairaut's form and singular solutions - Linear differential equations with constant coefficients - Homogeneous linear ordinary differential equations.

UNIT II DIFFERENTIAL EQUATIONS OF SECOND ORDER 12 Hrs

Linear differential equations of second order - Second order equation with constant coefficient with particular integrals for $e^{ax}, x^m, e^{ax} sin\, mx, e^{ax} cos\, mx$ - Method of variation of parameters - Ordinary simultaneous differential equations.

UNIT III PARTIAL DIFFERENTIAL EQUATION 12 Hrs

Partial differential equations - Formation of partial differential equations - Types of solutions - PDEs of the first order. Lagrange's solution.

UNIT IV PARTIAL DIFFERENTIAL EQUATION (CONTD…) 12 Hrs

Some special types of equations which can be solved easily by methods other than the general methods -Charpit's and Jacobi's general method of solution.

UNIT V SECOND AND HIGHER ORDER PARTIAL DIFFERENTIAL EQUATION 12 Hrs

Partial differential equations of second and higher order - Classification of linear partial differential equations of second order - Homogeneous and non-homogeneous equations with constant coefficients - Partial differential equations reducible to equations with constant coefficients.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Define Order, degree of ODE and PDE. Identify the methods to solve homogeneous and non-homogeneous ODE and PDE.

CO2 Classify ODE and PDE. Illustrate various methods to solve second order Differential equation and Partial differential equations.

CO3 Solve some special types of partial differential equations by Charpit's and Jacobi's method.

CO4 Analyze the solution of first order differential equations by various methods.

CO5 Evaluate higher order differential equations by method of variation of parameters.

CO6 Formation of ODE & PDE for the given function.

TEXT / REFERENCE BOOKS

1. P. Kandasamy, K. Thilagavathy, Mathematics for B. Sc Branch – I, Volume 3, 1st Edition, S. Chand and Co.Ltd., New Delhi, 2004.
2. M. K. Venkataraman and S. Krishnan, Engineering Mathematics, The National Publishing Co., 2010.
3. Dipak Chatterjee, Integral Calculus and differential equations, TATA McGraw S Hill Publishing Company Ltd., 2000.
4. Narayanan, T.K. ManichavasagamPillai, Calculus, Vol. I, S. Viswanathan Printers Pvt. Limited, 2007.
5. Dr. S. Sudha, Differential Equations & Integral Transforms, Emerald Publishers, 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1306	TRIGNOMETRY ANDTWO DIMENSIONAL ANALYTICAL GEOMETRY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- This course enables to evaluate trigonometric and inverse trigonometric functions.
- To solve trigonometric equations and applications.
- To study the applications of conics, asymptotes.

UNIT I EXPANSIONS AND HYPERBOLIC FUNCTIONS 12 Hrs

Expansions of $\cos^n\theta$, $\sin^n\theta$ in powers of $sin\theta$ and $cos\theta$-Expansion of $\tan^n\theta$ in powers of $tan\theta$-Powers of sines and cosines of θ in terms of functions of multiples of θ Expansions of $sin\theta$ and $cos\theta$ in a series of ascending powers of θ -Evaluation of limits-Hyperbolic functions-Relations between hyperbolic functions-Inverse hyperbolic functions-problems.

UNIT II SUMMATION OF TRIGONOMETRIC SERIES 12 Hrs

Logarithm of a complex number-Summation of trigonometrical series by the method of differences-Sum of series of n angles in A.P.-Summation of series using $C + iS$ form-Gregory's series-Euler's series.

UNIT III CONIC 12 Hrs

Geometric definition of Conic – the focus, directrix and eccentricity of a Conic - Classification of Conic into Ellipse, Parabola and Hyperbola based on the value of eccentricity -Parametric representation of Conics in standard form - Condition for a given straight line to be tangent to a Conic - Parabola-Equation of the tangent and normal to the parabola-Ellipse-Equation of the tangent and normal to the ellipse-conjugate diameters-Hyperbola-Equation of the tangent and normal to the hyperbola.

UNIT IV ASYMPTOTES 12 Hrs

Asymptotes - Conjugate hyperbola - Conjugate diameters - Rectangular hyperbola - Equation of the tangent and normal to the rectangular hyperbola.

UNIT V POLAR EQUATION 12 Hrs

Polar equation of a conic-Equation of the tangent and normal to the conic $l/r = 1 + e\cos\theta$ whose vectorial angle is α-Equation of asymtotes to the conic $l/r = 1 + e\cos\theta$ - Equation of polar to the conic $l/r = 1 + e\cos\theta$

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the formula of sin θ and cos θ in a series of ascending powers of θ.
CO2 Summarize the trigonometric series by the various methods.
CO3 Solve the problems on inverse hyperbolic functions and problems on equations of polar to conics.
CO4 Compare the tangent and normal equations of standard conics.
CO5 Evaluate the problems in Asymptotes, Conjugate hyperbola and diameters.
CO6 Construct the equation of polar to the conic

TEXT / REFERENCE BOOKS

1. Narayanan. S, ManicavachagomPillay. T.K, Trigonometry, S.Viswanathan (Printers and Publishers), 1980.
2. S. Arumugam& Others, Trigonometry, New Gamma Publications, Revised Edition, 1985.
3. ManicavachagomPillay, Natarajan, A Text book of Analytical Geometry (Part I-Two Dimensions), S.Viswanathan (Printers and Publishers), 1981.
4. A.Singaravelu, Algebra and Trigonometry, Vol – I & II Meenakshi Agency, Chennai, 2003.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 Questions of 2 Marks each – No choice **20 Marks**
PART B :2 Questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SBAB1314	COST ACCOUNTING AND BANKING	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To provide the knowledge in cost accounting
- To solve the problems based on material cost and labour cost.

UNIT 1 INTRODUCTION TO COST ACCOUNTING **9 Hrs**

Cost Accounting – Meaning, Scope, Objectives - Advantages and Limitations – Difference between Cost Accounting and Financial Accounting – Elements of Cost – preparation of Cost Sheet.

UNIT 2 MATERIAL COST **9 Hrs**

Material cost – Purchase Procedure – Material controlling techniques – Economic Order Quantity – Stores Ledger – Pricing of Issues – FIFO, LIFO, Simple Average and Weighted Average Methods.

UNIT 3 LABOUR COST **9 Hrs**

Labour Cost – Importance – Various Methods of Labour Cost Control – Methods of Wage Payment – Various Incentive Schemes – Labour Turnover.

UNIT 4 OVERHEADS **9 Hrs**

Overheads – Classification – Apportionment Of Overheads – Redistribution Of Overheads – Absorption of Overheads – Calculation of Machine Hour Rate

UNIT 5 INTRODUCTION TO BANKING **9 Hrs**

Banking – Meaning, objectives - Role of banking, Classification of Banks - functions of Commercial Banks- functions of RBI - E-Banking and Internet Banking - Meanings, scope, advantages and disadvantages.

Max. Hrs: 45 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1	Discuss the concepts in cost accounting
CO2	Classify various costs and overheads in an organization
CO3	Estimate the total cost incurred for making a product
CO4	Prepare cost sheet and Describe the material controlling techniques
CO5	Compute labour remuneration and incentives
CO6	Analyze the Banking types and services.

TEXT/ REFERENCE BOOKS

1. Jain &Narang, Cost Acounting, Kalyani Publishers Ludhiana, 2006.
2. Maheswari, Cost Accounting, Sultan chand& sons, New Delhi, 2002.
3. Jawaharlal, Cost Accounting, The McGraw Hill Companies, UP, 2007.
4. B.Santhanam, Banking theory Law & Practice,4thEd., Margham Publications, Chennai. 2005,
5. Dr.S.N.Maheswari, banking Theory Law & Practice, 10thEd., Sultan Chand & Sons, New Delhi. 2004
6. Sundharam&Varshney,Banking Theory &Practice, 17thEd., Sultan Chand & Sons, New Delhi. , 2005

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**

PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB2301	SPSS LAB	L	T	P	EL	C
		0	0	4	0	2

COURSE OBJECTIVES:

- To reinforce the basic skills to organize, manage and present data using SPSS.
- To impart to the students the knowledge of doing statistical data analysis
- To demonstrate graphically using frequency distributions and cumulative frequency distributions.

S.No.	Exp. No	Name of experiments	Duration
1.	1	Creation of SPSS data file	2
2.	2	Frequency Analysis- preparation of charts and diagrams	2
3.	3	Descriptive Statistics	2
4.		Extended experiment – 1	2
5.	4	Parametric Test – One sample t-test	2
6.	5	Parametric Test – Independent t-test	2
7.	6	Parametric Test – Paired t-test	2
8.		Extended experiment -2	2
9.	7	Non-parametric Test- Chi-square test	2
10.	8	Non-parametric Test - Mann Whitney test	2
11.	9	Non-parametric Test - Kruskal Wallis test	2
12.		Extended experiment – 3	2
13.	10	Correlation-Bivariate	2
14.	11	Rank Correlation	2
15.	12	Regression	2
16.		Extended experiment -4	2

Course Outcomes: At the end of the course, the student will be able to:

CO1 Recall the concepts in Data Analysis and create data files using SPSS.

CO2 Understand the Charts and Tables for frequency distributions using SPSS.

CO3 Compute the parametric tests for real world problems..

CO4 Solve the Non-parametric tests for real world problems

CO5 Evaluate Bivariate Correlation Coefficient using Karl Pearson and Spearman.

CO6 Apply Multiple Regression analysis technique for real life problems and predict the future values

TEXT/REFERENCE BOOKS

1. David M. Levine et al, Statistics for Managers using MS Excel,(6thEdition) Pearson, 2010
2. David R. Anderson, et al, An Introduction to Management Sciences, Quantitative approaches to Decision Making, (13thedition), South-Western College Pub, 2011.
3. William J. Stevenson, CeyhunOzgur, Introduction to Management Science withSpreadsheet, Tata McGraw Hill, 2009.
4. Wayne L. Winston, Microsoft Excel 2010, Data Analysis & Business Modeling, 3rdedition, Microsoft Press, 2011.
5. Vikas Gupta, Comdex Business Accounting with Ms Excel, 2010 and Tally ERP 9.0 Course Kit, Wiley India, 2012.
6. KiranPandya and SmritiBulsari, SPSS in simple steps, Dreamtech, 2011.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SMTB1404	THREE DIMENSIONAL ANALYTICAL GEOMETRY AND VECTOR CALCULUS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To understand the concepts of 3 dimensional analytical geometry
- To find shortest distance between skew line an orthogonal spheres.
- To analyze the differentiation and integration with vectors.

UNIT I RECTANGULAR CARTESIAN CO-ORDINATES **12 Hrs**

Direction cosines of a line – Direction ratios of the join of two points - Projection on a line – Angle between the lines - Equation of a plane in different forms - Intercept form- normal form - Angle between two planes - Planes bisecting the angle between two planes, bisector planes.

UNIT II PLANE AND STRAIGHT LINE **12 Hrs**

Equation of a line in different forms - reduction to symmetric form of a given line - angle between the lines - image of a point and a line with respect to a plane- plane and a line- Angle between a line and a Plane - Co-Planarity of two lines –Skew lines-Shortest distance between two skew lines.

UNIT III SPHERE **12 Hrs**

Equation of the sphere - general form – plane section of a sphere- tangent line and tangent plane – orthogonal spheres.

UNIT IV VECTOR DIFFERENTIATION **12 Hrs**

Limit of a vector function – Continuity of vector functions – Derivative of a vector function –– Scalar and vector point functions – Gradient of a scalar point function – Directional derivative of a scalar point function – Divergence and curl of a vector point function – Solenoidal vector – Irrotational vector – Vector identities.

UNIT V VECTOR INTEGRATION **12 Hrs**

Vector integration – Line integral – Application of line integral. Surface and Volume integrals – Applications - Gauss Divergence theorem. Stoke's theorem – Green's theorem.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Describe equation of a plane in different forms, define direction cosines and direction ratios of a line and find angle between two planes, Bisector planes.
CO2 Identify the angle between lines, angle between line and plane Intersection of two lines. Estimate shortest distance between two skew lines
CO3 Sketch the general form of sphere, Orthogonal sphere and plane section of a sphere.
CO4 Apply gradient to solve problems involving normal vectors to level surfaces.
CO5 Evaluate line integral, surface and volume integral.
CO6 Integrate surface and volume integrals using Gauss Divergence, Stokes and Greens theorem.

TEXT / REFERENCE BOOKS

1. P. R. Vittal and V. Malini, Vector Analysis, Margham Publications, Chennai, 2006.
2. S. Shanti Narayan, A Text Book of Vector Calculus, S. Chand and Co., New Delhi,1966.
3. K. Viswanatham& S. Selvaraj, Vector Analysis, Emerald Publishers, Chennai, Reprint 1999.
4. P. Duraipandian, LaxmiDuraipandian, Vector Analysis, Emerald Publishers, Chennai,Reprint 2003.
5. Shanthi Narayanan and Mittal P.K:Analytical Solid Geometry 16th Edition S.Chand& Co., New Delhi,2006.
6. T.K. ManickavasagamPillay and others S. Viswanathan Analytical Geometry – 3D Chennai, 2001.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 Questions of 2 Marks each – No choice **20 Marks**
PART B :2 Questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1405	FOURIER SERIES AND APPLICATION OF DIFFERENTIAL EQUATION	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- This course provides students to get exposed to the concepts of Fourier series.
- To prepare the students to know the Application of Differential Equations.
- To apply Fourier series in solving Partial Differential Equations.

UNIT I FOURIER SERIES **12 Hrs**

Definition- Dirichlets conditions- coefficients- Fourier series for the function defined in [c, c+2π],[c, c+2l] – odd and even functions in fourier series-Parseval's identity (without proof).

UNIT II FOURIER SINE AND COSINE SERIES **12 Hrs**

Half range cosine series and sine series of f(x) defined in [0,π], [0,l]- Parseval's Identity (without proof) - simple problems – Complex form of Fourier series-Harmonic Analysis.

UNIT III APPLICATION OF ODE **12 Hrs**

Particle dynamics: Simple Harmonic motion – Projectiles: – horizontal plane - trajectory – velocity of projection – angle of projection – Range - time of flight – greatest height - projectiles on inclined plane. Central orbit and Central forces: – differential equation of a path – pedal equation of a differential equation – velocity at any point of a central orbit – areal velocity – Kepler's laws of planetary motion.

UNIT IV APPLICATION OF PDE **12 Hrs**

One dimensional wave equation – Transverse vibration of finite elastic string with fixed ends – boundary and initial value problems – Fourier series solution – one dimensionl heat equation – steady and unsteady state – boundary and initial value problems – Fourier series solution.

UNIT V APPLICATION OF PDE **12 Hrs**

Two dimensional heat equation - steady state heat flow in two dimensions- Laplace equation in Cartesian and polar co-ordinates (excluding annulus) – Fourier series solution .

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the periods for trigonometric functions.
CO2 Understand and classify half range cosine and sine series
CO3 Apply methods to solve kepler's law of planetary motion, pedal equation of a differential equation
CO4 Distinguish ordinary differential equation and partial differential equation
CO5 Evaluate one dimensional heat equation with boundary and initial value condition.
CO6 Formulate two dimensional heat equation for Cartesian and polar coordinates.

TEXT /REFERENCESBOOK

1. George F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
2. S Narayanan & T K ManicavachogamPillay, Differential Equations.: S V Publishers Private Ltd., 1981.
3. G K Ranganath, Text book of B.Sc, Mathematics, Revised ed. New Delhi, India: S Chand and Company Ltd., 2011.
4. Frank Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA: McGraw-Hill, 1972.
5. S Narayanan, Dynamics, 16th ed. New Delhi: S Chand and Company Ltd., 1986.
6. N.P. Bali, Dynamics (Golden Series), Latest ed. New Delhi, India: Lakshmi Publications (p) Limited, 2004.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1406	NUMERICAL METHODS	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge in the field of numerical analysis
- To design and analyze the techniques for numerical problems
- To give approximate and accurate solutions to numerical problems

UNIT I DIRECT AND ITERATIVE METHODS **9 Hrs**

Direct Method: Gauss elimination method – Error Analysis– Iterative methods: Gauss- Jacobi and Gauss-Seidel – Convergence considerations – Eigen value Problem: Power method.

UNIT II NUMERICAL DIFFERENTIATION AND INEGRATION **9 Hrs**

Interpolation: Lagrange's and Newton's interpolation -- Errors in interpolation – Optimal points for interpolation - Numerical differentiation by finite differences – Numerical Integration: Trapezoidal, Simpson's and Gaussian quadratures – Error in quadratures.

UNIT III POLYNOMIAL APPROXIMATION **9 Hrs**

Norms of functions – Best Approximations: Least squares polynomial approximation – Approximation with Chebyshev polynomials – Piecewise Linear & Cubic Spline approximation.

UNIT IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9 Hrs**

Single-Step methods: Euler's method –Taylor series method – Runge-Kutta method of fourth order – Multistep methods: Adams-Bashforth and Milne's methods – Stability considerations – Linear Two point BVPs: Finite Difference method.

UNIT V NUMERICAL SOLUTION OF PARTIAL DIFFERNTIAL EQUATION **9 Hrs**

Elliptic equations: Five point finite difference formula in rectangular region – truncation error; One-dimensional Parabolic equation: Explicit and Crank-Nicholson schemes; Stability of the above schemes - One-dimensional Hyperbolic equation: Explicit scheme.

Max. Hrs: 45 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the types of direct method and iterative methods.
CO2 Classify the concepts of numerical differentiation and numerical integration.
CO3 Solve the polynomials using chebyshev method.
CO4 Discriminate between single step methods and multistep methods.
CO5 Determine the temperature for parabolic equations for various x values
CO6 Develop the temperature table for parabolic equation for suitable formulas

TEXT / REFERENCE BOOKS

1. Kandasamy P, Thilagavathy. K and G. Gunawathy, Numerical Methods, S.Chand& Sons, 3rd Revised Edition, 2013.
2. Balagurusamy. E, Numerical Methods, Tata Mcgraw Hill Publishing Company, 3rd Edition, 2000.
3. Isaacson E. and Keller, H.B., "Analysis of Numerical Methods" Dover Publication, 1994.
4. Philips G.M and Taylor P.J., "Theory and Applications of Numerical Analysis", Academic Press, 1996.
5. Jain M.K, "Numerical Methods for Scientific and Engineering computation", 3rd Edition, New Age International, 1999.
6. Conte S.D. and Carl de Boor, "Elementary Numerical Analysis", 3rd Edition, Tata McGraw-Hill Publishing Company. 2004.
7. Atkinson K.E., "An Introduction to Numerical Analysis", Wiley & Sons, 2nd Edition, 1989.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB2401	MATLAB FOR NUMERICAL METHODS	L	T	P	EL	C
		0	0	4	0	2

COURSE OBJECTIVES:

- To make the students to understand a broad range of experimental techniques
- To enable them to demonstrate their ability
- To use the techniques in conducting experiments and observations

List of Experiments

1 Introduction to MATLAB

2. Study of Vector and Matrix Operations

3. Solution of System of equations

   Gauss Elimination method

   Gauss Seidal method

4. Numerical Differentiation

5. Numerical Integration

   Trapezoidal

   Simpsons rule

6. Least square polynomial approximation

7. Solution of ODE

   Taylors series method

   Euler's method

   Rungekutta method of fourth order

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SMTB1501	ALGEBRA I	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To provide a first approach to algebra, which is one of the basic pillars of modern mathematics
- To study certain structures called groups, rings, fields, Euclidean ring and some related structures.
- To provide a comprehensive teaching for fundamental aspects for problem solving.

UNIT I INTRODUCTION **12 Hrs**

Definition of a group – some examples of groups – Some preliminary lemmas - Subgroups – A counting principle - Cosets and Lagrange's theorem.

UNIT II HOMOMORPHISM **12 Hrs**

Normal subgroups and Quotient groups - Homomorphism - Automorphism. Permutations groups –cayley's theorem

UNIT III RINGS AND IDEALS **12 Hrs**

Definition and example of rings – Some special classes of rings - Homomorphisms - Ideals and quotient rings.

UNIT IV QUOTIENT RINGS AND FIELDS **12 Hrs**

More Ideals and quotient rings – The field of quotients of an integral domain.

UNIT V EUCLIDEAN RINGS **12 Hrs**

A particular Euclidean ring – polynomial rings – polynomial fields over the rational field

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the examples of sets, left and right cosets.
CO2 Understand theorems under normal subgroup and quotient groups.
CO3 Illustrate ideals, homomorphism and quotient rings
CO4 Explain the field of quotient over an integral domain
CO5 Evaluate polynomial fields over the rational field.
CO6 Formulate polynomial rings of infinite rings

TEXT / REFERENCE BOOKS

1. Herstein, Topics in Algebra, John Wiley & Sons., 2nd Edition, Reprint 2007.
2. S. Arumugam and A. ThangapandiIssac, Modern algebra, New Gamma Publishing House, 2013.
3. T. K. ManicavachagamPillai, T. Natarajan, & K. S. Ganapathy, Algebra, Vol. I, S. Viswanathan Pvt. Limited, 2012.
4. Modern Algebra, M.L. Santiago, Tata McGraw-Hill Publishing Co. Ltd, 2001

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1502	REAL ANALYSIS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- This course aims to provide students with the specialist knowledge necessary for basic concepts in Real Analysis.
- The course includes axioms of real number systems, countable and uncountable sets.
- To learn the concepts of uniform convergence of sequences and series of functions, limit and continuity, Mean value theorem and Taylor's series.

UNIT I REAL AND COMPLEX FIELD **12 Hrs**

Introduction- ordered sets - fields- real field - the extended real number system - the complex field-Euclidean spaces.

UNIT II COUNTABLE AND UNCOUNTABLE SETS **12 Hrs**

Finite, countable and uncountable sets-metric spaces-compact sets-perfect sets-connected sets.

UNIT III CONVERGENT SEQUENCES **12 Hrs**

Convergent sequences - subsequences - Cauchy sequences-upper and lower limits-some special sequences and series - series of non-negative terms - the root and ratio tests-absolute convergence.

UNIT IV LIMIT AND CONTINUITY OF FUNCTION **12 Hrs**

Limits of functions – Continuous functions – Continuity and – Continuity and Connectedness – Monotonic Functions.

UNIT V MEAN VALUE AND TAYLOR'S THEOREM **12 Hrs**

The Derivate of a Real Function – Mean Value Theorems – Continuity of Derivatives – L'Hospital's Rule- Derivatives of Higher Order – Taylor's Theorem – Differentiation of Vector – Valued Functions.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Recall field and number system to identify the real field and complex field .
CO2 Classify the countable and Uncountable sets, metric spaces, compact and connected sets.
CO3 Explain convergent sequence to produce the absolute convergence
CO4 Distinguish limit and continuity of function
CO5 Evaluate the derivatives by Mean value theorem and by L'Hospital's Rule.
CO6 Construct the higher order derivatives by Taylors theorem,

TEXT / REFERENCE BOOKS

1. Walter Rudin, "Principles of Mathematical Analysis", 3rd Edition, McGraw–Hill International Editions, Singapore, Reprint 2012.
2. Tom M. Apostol, Mathematical Analysis, 2nd edition, Pearson, Narosa Publishing House, New Delhi, 2002.45 B.Sc (Mathematics) 2014-2015
3. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi, 2010.
4. Sterling K.Berberian, A first course in Real Analysis, 4th Edition, Springer India Pvt. Ltd., 2009.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1503	OPERATIONS RESEARCH	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To understand the importance of Operation Research.
- To Develop and Create Problem solving skills for any complex problems.
- To Solve Linear Programming Problems,Transportation and Assignment Problems.

UNIT I INTRODUCTION TO OR **12 Hrs**

Operations Research(OR)-Nature-Characteristics-Phases.-Role of OR in Decision making- Outline of OR Models Linear Programming - definition - mathematical formulation - graphical method.

UNIT II LINEAR PROGRAMMING PROBLEM **12 Hrs**

General linear programming problems – canonical and standard forms – simplex method -Two Phase Method - Big M methods. Dual Simplex method - Duality - properties - fundamental theorems of duality(statements only) -principle of duality - dual simplex method.

UNIT III TRANSPORTATION AND ASSIGNMENT PROBLEM **12 Hrs**

Transportation problem – Initial Basic feasible solution- Northwest corner method - Least Cost method - Vogel's approximation method –Optimum solution using MODI method - Assignment problems - Travelling salesman problems.

UNIT IV SEQUENCING AND SCHEDULING PROBLEM **12 Hrs**

Sequencing Problem with N jobs and 2 machines N Jobs 3 machines N Jobs and m machines and 2 Jobs m machines (Graphical method) - Project Management -Basic concepts–Network construction - Scheduling Critical Path Method (CPM) & Program evaluation review technique (PERT) – simple applications.

UNITV INVENTORY CONTROL REPLACEMENT MODEL **12 Hrs**

Inventory Control - Various Types of inventory models - deterministic inventory models - Production model, Purchase model -with and without shortage - Economic Order Quantity (EOQ) - Buffer stock -Shortage quantity - Probabilistic inventory models – Quantity Discount and Price Breaks.Replacement policy for items whose maintenance cost increases with time-Consideration of time value of money - Replacement policy- Individual, Group replacement of items that fail completely and suddenly.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the characteristics of operation research.
CO2 Understand the slack and surplus variables to find the optimal solution of an optimization problem.
CO3 Apply north west corner, least cost and vogel approximation method on transportation problem.
CO4 Explain an optimal sequence in which the jobs should be performed on the machines.
CO5 Evaluate the various types of inventory models.
CO6 Formulate the problem involves determining whether to replace them as a group or to replace individuals as they fail.

TEXT / REFERENCE BOOKS

1. KanthiSwarup, Gupta P.K., Man Mohan, “Operations Research, 12th Edition”, Sultan Chand Sons, Educational Publishers, New Delhi, 2004
2. S.D Sharma,”operation research Theory, Methods and Application”, 17th Edn., Kedar Nath Ram Nath Publication,2010.
3. Panner Selvam R., “Operations Research”, Prentice Hall of India Private Limited, New Delhi, 2006
4. Kalavathy S., “Operations research”, 2nd Edition, Vikas Publishing House Private Limited, New Delhi, 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1504	DATA ANALYTICS	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

:

- To prepare and motivate the students in the field of data analysis.
- To apply the R language for analysing data using statistical tools
- To apply the deep knowledge in fundamentals of statistics in real life applications.

UNIT I INTRODUCTION TO DATA ANALYSIS **9 Hrs**

Introduction – collection, classification and tabulation of data – Concept of primary and secondary data – Data - quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio – Data visualization - Bar diagram, pie chart, histogram, frequency curve and frequency polygon – Ogives- Introduction to statistical learning and R-Programming

UNIT II DESCRIPTIVE STATISTICS **9 Hrs**

Measures of central tendency - Measures of location of dispersions - Practice and analysis with R.

UNIT III BIVARIATE DATA **9 Hrs**

Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), Simple linear regression, principle of least squares and fitting of polynomials and exponential curves –Practice and analysis with R.

UNIT IV ANALYSIS OF TIME SERIES **9 Hrs**

Introduction to times series data - Components of a time series- Decomposition of time series - Trend - Measure of trend – Graphical method, Semi Average method, Moving Average method and Least Square method – Measurement of Seasonal Variation – Simple Average method, Ratio Trend method and Ratio Moving Average method.

UNIT V MULTIVARIATE ANALYSIS **9 Hrs**

Multivariate Techniques - Multiple Regression Analysis - Factor Analysis – Discriminant Analysis – Cluster Methods - Artificial Neural Networks.

Max. Hrs: 45 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Recall the basics of statistics and Identify the level of measurement.
CO2 Estimate the measures of central tendency and location of dispersions using R
CO3 Analyse the analysis of variance for randomized block design and latin squares using R.
CO4 Distinguish the different types of analysis, artificial neural networks, fuzzy logic and genetic algorithm.
CO5 Evaluate Type I and Type II errors in significance test using R.
CO6 Create likelihood ratio property and critical values using R.

TEXT / REFERENCE BOOKS

1. D.C. Montgomery &E.Peck- Introduction to Linear Regression Analysis, 2012.
2. A.M. Mood, F.A. Graybill& D.C. Boes. Introduction to the Theory of Statistics, 2017
3. N. Draper & H. Smith- Applied Regression Analysis, 1998
4. S. M. Ross, “A first course in Probability”, Prentice Hall.2007
5. I. R. Miller, J.E. Freund and R. Johnson, “Probability and Statistics for Engineers”. Fourth Edition, PHI.2020
6. A. M. Mood, F.A. Graybill and D.C. Boes, “Introduction to the Theory of Statistics”, McGraw Hill Education. 2017
7. Jared P. Lander- R for Everyone: Advanced Analytics and Graphics, 2008

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB2501	DATA ANALYTICS LAB	L	T	P	EL	C
		0	0	4	0	2

COURSE OBJECTIVES:

- To acquire basic knowledge of R laboratory techniques.
- To educate the students about basics of data acquisition.
- To investigate data analysis and interpretation of results.

LIST OF EXPERIMENTS

1. Programming Method
2. Implementation using R & R-studio
3. Debugging
4. Library Function, file
5. R statistical programming language
6. Introduction to R, Functions
7. Control flow and Loops
8. Working with Vectors and Matrices
9. Reading in Data, Writing Data
10. Working with Data
11. Manipulating Data
12. Simulation
13. Linear model
14. Data Frame
15. Graphics in R

Course Outcomes: At the end of the course, the student will be able to:

CO1 Able to download R software and R studio software.
CO2 Get familiar with R software and learn basics of R with descriptive statistics. Access online resources for R and import new function packages into the R workspace. Import, review, manipulate and summarize data-sets in R.
CO3 To educate the basics of data acquisition ,data analysis and interpretation of results.
CO4 Perform correlation, regression analysis and appropriate statistical tests for real life situations using R
CO5 Fit the distributions to a real life data using R-software.
CO6 Compute probabilities and fitting of probability distribution with R environment.

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks: 100 **Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SMTB1601	ALGEBRA II	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To solve the problems in linear algebra arise in a wide variety of scientific and engineering applications including the design of structures, the analysis of electrical networks, and the modeling of chemical processes.
- To develop the ability to demonstrate an understanding of the underlying principles of the Course.
- To solve unseen mathematical problems involving an understanding of the concepts and applications of these methods.

UNIT I VECTOR SPACES **12 Hrs**

Vector Spaces – Definition – Simple properties – Examples – Homomorphism – Sub space – Quotient spaces – Internal direct sum – External direct sum.

UNIT II DIMENSIONOFVECTORSPACES **12 Hrs**

Linear Independence – Dimension of a Vector space – Bases - Dimension of Quotient spaces.

UNIT III INNER PRODUCT SPACES **12 Hrs**

Inner product spaces – Definition – Examples – Applications – Orthogonal complement of a sub space – Ortho normal & Ortho normal Basis - Gram Schmidt Orthogonalization process.

UNIT IV LINEAR TRANSFORMATION I **12 Hrs**

Linear Transformation – The Algebra of linear transformations – Characteristic roots – Matrix representation of linear transformations– Canonical forms – Triangular forms.

UNIT V LINEAR TRANSFORMATION II **12 Hrs**

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

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the examples of vectors, scalars. Identify algebraic objects, finite group, cyclic.
CO2 Understand the concept of equivalence classes.
CO3 Apply Gram Schmidt Orthogonalization process to orthogonalize the basis.
CO4 Analyse the linear function defined on finite dimensional vector space.
CO5 Evaluate Nilpotent matrix, Eigen values of Nilpotent linear transformation
CO6 Hypothesize canonical form, kernels of powers of nilpotent linear transformation

TEXT / REFERENCE BOOKS

1. I.N. Herstein, Topics in Algebra, 2nd Edition, John Wiely, NewYork, 2013.
2. A.R.Vasistha, A first course in modern algebra Krishna PrakasanMandhir, 9, Shivaji Road, Meerut (UP).
3. ViswanathaNaik, Modern Algebra, Emerald Publishers, Anna Salai, Chennai, 2001
4. Dr.R.Balakrishnan and Dr.N.Ramabadran, A Text Book of Modern Algebra, Vikas Publishing Limited, NewDelhi.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**

PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB1602	COMPLEX ANALYSIS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- The course is designed to introduce the fundamental ideas of the functions of complex variables
- To develop a clear understanding of the concepts of Complex Analysis such as analytic functions, complex integrals, Taylor's and Laurent's series
- To allow students to work effectively with the concepts.

UNIT I ANALYTIC FUNCTION **12 Hrs**

Complex Numbers - Point at Infinity- Stereographic Projection - 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**

Mapping Conformal Mapping – The transformation – The transformation w = az + b, w = z^2, w = 1/z, w = $\sqrt{z}$, w = e^z, Bilinear Transformation and special Bilinear Transformation.

UNIT III CONTOUR INTEGRAL **12 Hrs**

Integrals Contours - Line Integrals-Cauchy- Goursat's Theorem (without proof) Cauchy's Integral Formula - Derivatives of Analytic Functions - Maximum Modulus Theorem.

UNIT IV TAYLOR'S AND LAURENT'S THEOREM **12 Hrs**

Power series - Taylor's and Laurent's Theorem - Singularities and Classification – Problems.

UNIT V EVALUATION OF INTEGRAL **12 Hrs**

Cauchy's Residue theorem – Evaluation of integrals of the following types - $\int_0^{2n} f(\cos\theta, \sin\theta)d\theta$, $\int_{-\infty}^{\infty} f(x)\sin ax\, dx$, $\int_{-\infty}^{\infty} f(x)\cos ax\, dx$, 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.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1	Define complex numbers, function of a complex variable, limits, continuity, derivatives, analytic function, and harmonic function.
CO2	Summarize the properties of analytic function.
CO3	Solve the complex integral using Cauchy's integral formula and Cauchy residue theorem
CO4	Analyze standard transformations, simplify and reduce the real integral into complex integral.
CO5	Evaluate complex integral by Cauchy's integral formula and its derivatives
CO6	Construct the analytic function using Milne Thompson method.

TEXT / REFERENCE BOOKS

1. S. Narayanan and T. K. ManicavachagamPillay, Complex Analysis, Revised Edition,S. Viswanathan Printers & Publishers, 2002.
2. P.Duraipandian and LaxmiDuraipandian, Complex Analysis, Emerald Publishers, Chennai,1999.
3. S.Ponnusamy, Foundations of Complex Analysis, NarosaPublishing House, New Delhi.2000.
4. Murray R. Spiegel, Theory and Problems of Complex Variable, Tata-McGraw Hill Edition, New Delhi.2005.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5104	ABSTRACT ALGEBRA	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To express cyclic groups, find a generator for a subgroup of a given order
- To determine whether or not they are isomorphic, write precise and accurate mathematical objects in ring theory
- To understand concepts such as ideals and quotient rings, the concept of ring homomorphism, as well as investigate properties of vector spaces and subspaces using linear transformations

UNIT I GROUP THEORY **12 Hrs**

Normal Subgroups and Quotient groups-Homomorphism- Conjugacy - Cauchy theorem for abelian group -Sylow's theorem.

UNIT II RING THEORY **12 Hrs**

Ideals and Quotient rings-More ideals and quotient rings-Euclidean rings-The Field of Quotients of an Integral Domain-A particular Euclidean ring

UNIT III RING THEORY (CONTINUED) **12 Hrs**

Polynomial rings-Polynomials over the Rational Field-Polynomial Ring over Commutative rings.

UNIT IV FIELDS **12 Hrs**

Field Extension -Extension fields, Roots of Polynomials more about roots- Splitting field

UNIT V FIELDS (CONTINUED) **12 Hrs**

Elements of Galois Theory-bounded on the size of G-Fundamental theorem of Galois theory-Fields.

Max Hrs: 60 Hrs.

COURSE OUTCOME:

CO1 Identify Homomorphism of groups, Automorphism, permutation groups, symmetric groups.
CO2 Classify ideals and types of rings
CO3 Compare polynomial ring over rational field and commutative ring
CO4 Analyze about roots of polynomial in extension field and splitting field
CO5 Apply elements of Galois theory
CO6 Constructing the relation between ring and field using Galois theory

REFERENCE BOOKS:

1. N.Herstein, Topics in Algebra, Second Edition, John Wiley& Sons, Pvt.Ltd, 2000.
2. P.B.Bhattacharya, S.K. Jain and S.R.Nagpaul, Basic Abstract Algebra, Second Edition, Cambridge University Press, Re printed 2009.
3. John B.Fraleigh, AFirst Course in Abstract Algebra, Addison Wesley Publishing Company Third Impression, 2008.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5105	MEASURE THEORY AND INTEGRATION	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- The Course introduce the Riemann integration
- To develop the Lebesgue Measure and Borel Measure
- To gain understanding the abstract measure theory and main properties of integral

UNIT- I RIEMANN INTEGRATION **12 Hrs**

Definition and existence of the integral, properties of the integral, integration and differentiation, Rectifiable Curves.

UNIT-II LEBESGUE MEASURE **12 Hrs**

Measure on a real line – Lebesgue Outer measure – Measurable sets – Regularity – measurable functions.

UNIT-III BOREL MEASURE **12 Hrs**

Borel & Lebesgue measurability– Integration of Functions of a real variable – integration of non-negative functions – The General Integral.

UNIT-IV ABSTRACT MEASURE SPACE **12 Hrs**

Abstract Measure Space – Measure and Outer measure – Uniqueness of the extension – Completion of a measure – Measure space – Integration with respect to measure

UNIT-V THE HAHN JORDAN DECOMPOSITION **12 Hrs**

Signed measure and their derivatives – The Hahn Decomposition – The Jordan Decomposition – The Radon Nikodym theorem – some applications of the The Radon Nikodym theorem – Measure and Integration in a Product space – Measurability in a Product Space – The Product Measure and Fubini's theorem.

Max Hrs: 60 Hrs

Course Outcome: At the end of the Course, the Student will be able to

CO1 Understand the properties Riemann-Stieltjes Integral.

CO2 Define Measure on a real line , Lebesgue outer measure , Measurable sets and measurable functions.

CO3 Distinguish between Borel & Lebesgue measurability.

CO4 Analyze the concept of Abstract Measure Space, Completion of a measure , Measure space and Integration with respect to measure.

CO5 Apply the concept of Hahn Decomposition and Jordan Decomposition

CO6 Evaluate problems using Radon Nikodym theorem and Fubini's theorem.

TEXT/ REFERENCE BOOKS:

1. G. De Barra, Measure Theory and Integration, New Age International Pvt Ltd, 1997
2. H.L. Royden, Real Analysis, Third Edition, PHI, 2009.
3. Inder K. Rana, An Introduction to Measure and Integration, Second Edition, Narosa, 2007
4. Walter Rudin, Principlesof Mathematical Analysis, Third edition, Mcgraw-Hill International Editions, 2017.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**

PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5106	STATISTICAL INFERENCE AND STOCHASTIC PROCESS	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To Understand the probability, parametric, Non parametric test and basic of stochastic processes
- To study the real life experiments using ANOVA (design of experiment), Markov chain, Poisson process and its variations.
- To determine the higher order transition probabilities.

UNIT I THEORY OF ESTIMATION **9 Hrs**

Properties of estimates - asymptotically most efficient estimates - Likelihood function - Cramer-Rao inequality - Rao-Black-Well's theorem - Properties of Maximum likelihood estimates - Problems related to Maximum likelihood estimates.

UNIT II THEORY OF HYPOTHESIS **9 Hrs**

Power function and OC function –Errors - Most Powerful test- Uniformly Most Powerful test - Unbiased test - Neyman-Pearson fundamental Lemma - Problem.

UNIT III NON-PARAMETRIC TEST **9 Hrs**

Introduction - Kolomogorov Smirnov test for two samples - sign test - Wald WolfowizRun test - Median test for two samples and Mann-Whitney U-test.

UNIT IV DESIGN OF EXPERIMENTS **9 Hrs**

Analysis of variance - One-way classification - Two way classification - Principles of Experimental design - CRD, RBD and LSD and simple problems.

UNIT V STOCHASTIC PROCESSES **9 Hrs**

Specification of SP - Markov chain; transition probabilities - Determination of higher order transition probabilities - Chapman-Kolmogorov equation - Poisson processes (introduction only).

Max Hrs: 45 Hrs

Course Outcome: At the end of the course, the student will be able to

CO1 Understanding Cramer-Rao inequality ,Rao-Black-Well's theorem, Maximum likelihood estimates, Power function and OC function.
CO2 Analyse Cramer-Rao inequality; Rao-Black-Well's theorem ,Neyman-Pearson fundamental Lemma.
CO3 Solve the non-parametric test to solve the problem.
CO4 Evaluate using one-way and two-way ANOVA. Distinguish between CRD, RBD and LSD.
CO5 Understanding Stochastic process and Poisson Process.
CO6 Apply Transition Probability matrix and Poisson Processes.

TEXT/REFERENCE BOOKS:

1. MarekFisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, 1976
2. H.C.Saxena&P.V.Surendran, Statistical Inference, S.Chand. 1994
3. S.C.Gupta&V.K.Kapoor, Fundamentals of Applied Statistics ,S.Chand. 2014
4. J.Medhi, Stochastic Processes, New Age International Publishers. 1994
5. W.Feller, An Introduction to Probability Theory and its Applications ,Revised Volume I, Third Edition, Wiley,2008
6. J.L.Doob, Stochastic Processes, Wiley Inter Science,1991.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5107	MATHEMATICAL COMPUTATION WITH PYTHON	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

- The course is designed to introduce the fundamental ideas of the mathematical computation Python
- To develop a clear understanding of the concepts of Python.
- To acquire skills to solve various mathematical models

UNIT I PYTHON BASICS **9 Hrs**

Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

UNIT II BEGINNING PYTHON PROGRAMMING **9 Hrs**

Creating Python Programs: Input and Output Statements, Control statements (Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass), Defining Functions, default arguments, Errors and Exceptions

UNIT III SYMBOLIC MATHEMATICS **9 Hrs**

Introduction to the SymPy library for symbolic mathematics-Symbolic variables and expressions - Simplification, expansion, and substitution of expressions-Solving equations and systems of equations symbolically

UNIT IV NUMERICAL COMPUTATION **9 Hrs**

Introduction to the NumPy- library for numerical computations- Working with arrays and matrices-Mathematical operations with NumPy arrays- Numerical differentiation and integration using SciPy- Solving Differential Equations- root finding.

UNIT V DATA VISUALIZATION WITH PYTHON **9 Hrs**

Basic Plotting – Polynomial Fitting using matplotlib- Plotting trigonometric plotting using Matplotlib.

Max Hrs: 45 Hrs

COURSE OUTCOME: At the end of the course, the student will be able to

CO1 To provide Basic knowledge of Python
CO2 To learn how to design and program Python applications
CO3 Develop proficiency in using SymPy, the symbolic mathematics library in Python
CO4 To learn Numerical computations with python
CO5 Understand different customization options available in Matplotlib to enhance the appearance and readability of the visualizations.
CO6 Explore different styles and themes available in Matplotlib for creating visually appealing plots

TEXT/REFERENCE BOOKS:

1. Allen Downey, Jeffrey Elkner, Chris Meyers.How to think like a computer scientist learning with Python / 1st Edition,2012
2. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705.
3. Fuhrer, Claus, Jan Erik Solem, and Olivier Verdier. *Scientific Computing with Python 3*. Packt Publishing Ltd, 2016.
4. Johansson, Robert. *Numerical Python: A Practical Techniques Approach for Industry*. Apress, 2015.
5. Millman, K. Jarrod, and Michael Aivazis. "Python for scientists and engineers." *Computing in science & engineering* 13.2 (2011): 9-12.

USEFUL WEBSITES:

1. http://docs.python.org/3/tutorial/index.html
2. http://interactivepython.org/courselib/static/pythonds
3. http://www.ibiblio.org/g2swap/byteofpython/read/

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB6101	MATHEMATICAL COMPUTATION WITH PYTHON LAB	L	T	P	EL	C
		0	0	4	0	2

COURSE OBJECTIVES:

- To acquire basic knowledge of Python Programming .
- To educate the students about basics of data acquisition.
- To investigate basic mathematical operations

List of Experiments:

1. Introduction to Python Programming
2. Simple Python programs in Matrices
    - Addition, Subtraction
    - Matrix multiplication and inverse of a matrix
    - Determinant of a matrix
    - Eigen values and Eigen vectors
3. Basic mathematical operations
    - Sum of natural numbers
    - Finding factorial of a number
    - Finding square root and exponential of a given number
4. Program with relational conditional and logical Operators
    - LCM and DCD of numbers
    - Finding max and min of given numbers
5. Symbolic computations
    - Program to check the consistency of given system of equations
    - Program to solve the system of equations
    - Program to find the root of the polynomial equation
6. Numerical Computation using NumPy and Scipy
7. Differentiation and Integration
    - Program to find the derivatives of the given function
    - Partial derivative of a given function
    - Find the limit of a function
8. Plotting using matplotlib
    - Plotting standard curves
    - Line plot
    - Bar plot
    - Histogram
9. Statistics
    - Mean
    - Median
    - Mode
10. Solution of ordinary differential Equation

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SMTB5201	DIFFERENTIAL EQUATIONS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To distinguish linear, nonlinear, partial and ordinary differential equations
- To Understand Sturm theorem and analyze linear and non linear system,
- To obtain power series solutions of Gauss's hyper geometric equations

UNIT I SECOND ORDER LINEAR EQUATIONS **12 Hrs**

Second order linear equations - The general solution of the homogeneous equation –The use of Known Solution find another–The homogeneous equation with constant coefficients - The method of Variation of Parameters

UNIT II POWER SERIES SOLUTION **12 Hrs**

Review of Power Series Solution – Series solutions of first order equations - Second order linear equations - ordinary points - Singular Point - Regular Singular Point - Indicial Equations.

UNIT III POWER SERIES SOLUTION(CONTINUED) **12 Hrs**

Frobenius Series Solution – Solution of Bessel Equation - Gauss's hyper geometric equation –The Point at infinity.

UNIT IV SPECIAL FUNCTIONS **12 Hrs**

Legendre polynomials - Rodrigue formula - Generating Function - Recurrence relation - Properties of Legendre polynomials - Bessel functions – Recurrence relation - Properties of Bessel functions.

UNIT V SYSTEMS OF FIRST ORDER EQUATIONS, EXISTENCE AND UNIQUENESS OF SOLUTIONS **12 Hrs**

Linear systems – Homogeneous linear systems with constant coefficients – The Method of Successive approximation – Picard's theorem.

Max Hrs: 60 Hrs

Course Outcome: At the end of the course, the student will be able to

CO1	Understanding the methods to obtain non-trivial solutions to second order linear complete and reduced differential equations.
CO2	Compare the properties and essential characterization of the solution of reduced second order linear differential equation by direct analysis of its equation.
CO3	Solve using power series, first and second order ordinary differential equation.
CO4	Apply Gauss Hyper geometric equation, homogeneous differential equation for large values of the independent variable.
CO5	Compare the concept of special functions
CO6	Evaluate the system of first order linear differential equation, solution to homogeneous linear system with constant coefficients.

REFERENCE BOOKS:

1. G.F. Simmons, Differential Equations with applications and Historical notes, Fifth edition, Tata McGraw-Hill PublishingCompany, New Delhi, 2002.
2. M. D. Raisinghania, Advanced Differential Equations, Seventh Revised Edition S. ChandandCompany Ltd, New Delhi, 2000.
3. Earl. A. Coddington, An Introduction to Ordinary Differential Equations,PHI,1989.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**

PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5202	TOPOLOGY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To enable the students to understand a formation of new spaces from old one using product
- To generalize the concept of distance, open sets, closed sets and related theorems in real line and to learn basic concepts in Metric Spaces, Topological Spaces, compact spaces and connected spaces.
- To understand the concept of Tychonoff and Urysohn theorem

UNIT I TOPOLOGICAL SPACES AND CONTINUOUS FUNCTIONS **12 Hrs**

Topological spaces, Basis for a topology, the order topology, product topology, subspace topology, closed sets and limit points, continuous functions, product topology.

UNIT II TOPOLOGICAL SPACES AND CONNECTEDNESS **12 Hrs**

The metric topology, the metric topology (continued), connected spaces.

UNIT III COMPACT SPACES AND TYCHONOFF THEOREM **12 Hrs**

Compact spaces, Limit point compactness, The Tychonoff theorem.

UNIT IV COUNTABILITY AND SEPARATION AXIOMS **12 Hrs**

The countability Axioms, The separation axioms, The Urysohn Lemma, The Urysohn Metrization theorem, Completely regular spaces.

UNIT V COMPLETE METRIC SPACES AND BAIRE SPACES **12 Hrs**

Complete Metric Spaces, compactness in metrics Spaces, Baire Spaces.

Max Hrs: 60 Hrs

Course Outcome: At the end of the course, the student will be able to

CO1 Recall topological space, Metric space, Compact space Baire space and complete metric space.
CO2 Compare Tychonoff's theorem, locally compact spaces and Compactness of metric spaces
CO3 Apply the concept of compact spaces for deriving Tychonoff theorem.
CO4 Analyze connected spaces, the components of a space and Totally disconnected spaces.
CO5 Summarize the axioms on countability and separations
CO6 Produce the application of Stone-Weierstrass theorems

REFERENCE BOOKS:

1. James R. Munkres, Topology A First Course, PHI, Second Edition, 2000
2. Sze-TsenHu, Elements of General Topology, Holden Day ,Inc., 1969.
3. K.D.Joshi ,Introduction to General Topology, Wiley Eastern Ltd., Third Edition, 2001.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5203	ADVANCED DATA ANALYTICS	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES

- To enable the students to learn, understand and practice R, which include the study of data standardization,
- To understand Z score, probability distribution, focusing on time series by understanding through real–world statistical applications.
- To identify an appropriate probability distribution for a given discrete or continuous random variable

UNIT I INTRODUCTION TO R **9 Hrs**

Introduction to R – Downloading and Installing R –. Getting Data into R: First Step in R: Typing in Small Datasets – Concatenating Data with c Function – Combining Variables with the c, cbind, rbind Functions - Vector Function –Matrix - data frame – List - Importing Excel Data – Accessing Data from other Statistical Packages – Accessing the Database. Functions - The Attach Function – Exporting Data - The Tapply Function – The Supply and Lapply Function – The Summary and Table Function.

UNIT II DATA STANDARDIZING **9 Hrs**

Data standardizing – Z Score – Negative Z Score – Continuous Distributions - Compute proportions – Relative Frequency histogram - Normalized Distribution using Z table.

UNITI II PROBABILITY DISTRIBUTION **9 Hrs**

Probability Distributions - Probability of mean – location of mean distribution - Sampling Distributions — Klout Sampling Distribution – Understanding Shape of Distribution – Standard Error - Standard Deviation of sampling distribution – Ratio of Sampling Distribution - Central Limit Theorem R – Mean of sample means Advanced Analytics Regression Analysis – Simple Regression Analysis - – Logisitc Regression.

UNIT IV INTRODUCTION TO TIME SERIES **9 Hrs**

Introduction to time series data - application of time series from various fields -Modelling time series as deterministic function plus IID errors - Components of a time series (trend, cyclical and seasonal patterns, random error) Decomposition of time series - Estimation of trend: free hand curve method, method of moving averages, fitting various mathematical curves and growth curves.

UNIT V ANALYSIS OF TIME-SERIES **9 Hrs**

Analysis of time-series: Different components of a time series. Determination of trend by free hand smoothing. Method of moving average and by fitting of a mathematical curve. Determination of seasonal indices by method of trend ratios and ratios to moving averages.

Max Hrs: 45 Hrs

Course Outcome: At the End of the Course, the student will be able to

CO1	Identify the command for exporting and accessing data from other statistical packages using R software
CO2	Understand normalized distribution using Z table and standard error.
CO3	Apply the method of moving average in time series.
CO4	Analyze the components of time series and determination of trend.
CO5	Evaluate the proportion in data standardizing
CO6	Organize the data to fit a mathematical curve using time series.

TEXT/REFERENCE BOOKS

1. Chatfield C. ,The Analysis of Time Series – An Introduction, Chapman & Hall.2001
2. Brockwell and Davis, Introduction to Time Series and Forecasting (Springer Texts in Statistics), 2nd Edition, 2010
3. Johnson, R.A. And Wichern, D.W. Applied Multivariate Analysis, 6th Edn., Pearson & Prentice Hall, 2007.
4. Goon, A.M., Gupta, M.K. and Dasgupta, B., Fundamentals of Statistics, Vol. I, 8th Edn. The World Press, Kolkata, 2002
5. Hadley Wickham, gplot2: Elegant graphics for data analysis, Springer http://www.springerlink.com.proxy.lib.umich.edu/content/978-0-387-98140-6/contents/, 2009.
6. Phil Spector, Data Manipulation with R, Springer http://www.springer.com/statistics/computanional+statistics/book/978-0-387-74730-9, 2008.
7. Leland Wilkinson, The Grammar of Graphics, Springer http://www.springerlink.com.proxy.lib.umich.edu/content/978-0-387-24544-7/contents/, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5204	ADVANCED NUMERICAL METHODS	L	T	P	EL	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To Understand analytical, developmental and technical principles that relate to Numerical Linear Algebra
- To understand the Numerical Methods for solving Differential Equations
- To develop the academic abilities required to solve problems and applications in Numerical methods

UNIT I TRANSCENDAL AND POLYNOMIAL EQUATIONS **9 Hrs**

Transcendental and Polynomial Equations: Iteration method based on Second degree equations: The Chelyshev Method – Multipoint Iteration Methods – The Bridge Vieta Method – The Baristow Method – Graeffe's root Square Method

UNIT II SYSTEM OF EQUATIONS **9 Hrs**

The System of Algebraic Equations and Eigen Value Problems: Iteration Methods-Jacobi Method, Guass Seidel Method, Successive Over Relaxation Method – Iterative Method for A-1 – Eigen Values and Eigen Vectors – Jacobi Method for symmetric Matrices , Power Method.

UNIT III INTERPOLATION AND APPROXIMATION **9 Hrs**

Interpolation and Approximation – Hermite Interpolation – Piecewise cubic Interpolation and cubic Spline interpolation – Bivariate interpolation – Lagrange and Newton's Bivariate interpolation – Least Square approximation – Gram-Schmidt Orthogonalizing Process.

UNIT IV DIFFERENTIATION AND INTEGERATION **9 Hrs**

Differentiation and Integration; Numerical Differentiation – Methods Based on Interpolation – Partial Differentiation – Numerical Integration – Methods Based on Interpolation – Methods Based on Undetermined Coefficients – Gauss Quadrature methods - Gauss Legendre and Gauss Chebyshev Integration Methods – Double Integration – Trapezoidal and Simpson's Rule – Simple Problems

UNIT V ORDINARY DIFFERENTIAL EQUATIONS **9 Hrs**

Ordinary Differential Equations: Numerical Methods – Euler Method – Backward Euler Method – Mid-Point Method – Rungekutta Methods – Implicit RungeKutta Methods – Predictor – Corrector Methods.

Max Hrs: 45 Hrs

Course Outcome: At the end of the course, the student will be able to

CO1 Recall transcendental and polynomial equations
CO2 Summarize the different method for solving eigen value and eigen vector
CO3 Choose appropriate interpolation formula such as Lagrange, Newton's Bivariate interpolation.
CO4 Analyze trapezoidal and Simpsons rule for double integration
CO5 Evaluate the ordinary differential equations by numerical methods such as Euler method, RungeKutta method.
CO6 Formulate Numerical integration based on Gauss Legendre and Gauss Chebyshev Integration Methods

REFERENCE BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, Numerical Methods for Scientific and Engineering Computation, Fourth Edition. 2007
2. Samuel.D.Conte and Carl DeBoor, Elementary Numerical Analysis, Revised Third Edition, 1972
3. F.B.Hildebr, Introduction to Numerical Analysis, TMH, 1991.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB6201	MATLAB FOR ADVANCED NUMERICAL METHODS	L	T	P	EL	C
		0	0	4	0	2

COURSE OBJECTIVES:

- It is designed to give students a basic understanding of MATLAB
- To process experimental data
- To make plots to visualize experiments and extract conclusion

LIST OF EXPERIMENTS

1. Introduction to MATLAB
2. Study of Vector and Matrix Operations
3. Determination of roots of a polynomial
4. Solution of Linear equations for Underdetermined and Overdetermined cases.
5. Determination of Eigen values and Eigen vectors of a Square matrix.
6. Determination of polynomial using method of Least Square Curve Fitting.
7. Numerical Differentiation and Partial Differentiation
8. Numerical Integration and Double integration.
9. Solution of differential equation using 4th order Runge- Kutta method.
10. Solution of differential equation using Taylor's series method.
11. Solution of implicit Rungekutta method

REFERENCES:

1. Fausett L.V., Applied Numerical Analysis using MATLAB, 2nd Edition, Pearson Education. 2007.

2. Chapra S.C. and CanaleR.P,Numerical Methods for Engineers, 5th Edition, McGraw Hill, 2006

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SMTB5301	COMPLEX INTEGRATION	L	T	P	EL	C
		3	2	0	0	4

COURSEOBJECTIVES:

- To enable the students to recognize and apply the cauchy's integral formula in complex integration.
- To determine the taylor series of a given function
- To understand gamma functions and their properties and relationships

UNIT I FUNDAMENTAL THEOREMS OF COMPLEX INTEGRATION 12 Hrs

Line integrals, Rectifiable arcs, line integrals as functions of arcs, Cauchy's theorem for a rectangle, Cauchy's theorem in a disk – Cauchy's integral formula –The index of a point with respect to a closed curve, The integral formula, Higher derivatives.

UNIT II LOCAL PROPERTIES OF ANALYTICAL FUNCTIONS 12 Hrs

Removable singularities, Taylor's theorem, zeros and poles – The local mapping, the maximum principle – chains and cycles, simple connectivity, Homology.

UNIT III THE GENERAL FORM OF CAUCHY'S THEOREM AND CALCULUS OF RESIDUES 12 Hrs

The general statementof Cauchy's theorem, proof of Cauchy's theorem, locally exact differentials. The calculus of residue-The residue theorem, the argument principle, Evaluation of definite integrals.

UNIT IV HARMONIC FUNCTIONS AND POWER SERIES EXPANSIONS 12 Hrs

Harmonic functions – definition and basic properties, The mean-value property, Poisson's formula, Schwarz's theorem, the reflection principle – Power series expansions – Weierstrass's theorem, The Taylor series, The Laurent series.

UNIT V PARTIAL FRACTIONS AND FACTORIZATION 12 Hrs

Partial fractions, infinite products, canonical products, the gamma functions.

Max Hrs: 60 Hrs

Course Outcome: At the end of the course, the student will be able to

CO1 Define a line integral, index of a point, removable singularities, chains and cycles, harmonic function,.
CO2 Classify the complex integral based on Cauchy's integral formula and formula for derivatives.
CO3 Solve the complex integral using Cauchy's integral formula and Cauchy residue theorem.
CO4 Differentiate Taylor's theorem and Taylor's series..
CO5 Evaluate complex integral by Cauchy's integral formula and its derivatives.
CO6 Construct the proofs of all theorems; develop Taylor's series and Laurent's series for a given function.

TEXT/REFERENCE BOOKS:

1. V.Karunakaran, Complex Analysis, Second Edition, Narosa Publications, 2005.
2. Lars.V.Ahlfors, Complex Analysis, Fourth Edition, McGraw-HillInternationalEdition,2000.
3. S.Ponnusamy, Foundations of Complex Analysis, Second Edition, Narosa Publications, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5302	FUNCTIONAL ANALYSIS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To introduce some fundamentals and basic theorems on functional analysis,
- To give a working knowledge of the basic properties of Banach spaces, Hilbert spaces and bounded linear operators and ideas of adjoints
- To demonstrate significant applications of the theory of functional analysis.

UNIT I BANACH SPACE **12 Hrs**

Banach Space: The definition and some examples, Continuous linear transformations, The Hahn-Banach theorem.

UNIT II NATURAL IMBEDDING OF BANACH SPACES **12 Hrs**

Banach space(continued): The natural imbedding of N of N**, The open mapping theorem, The conjugate of an operator.

UNIT III HILBERT SPACES **12 Hrs**

Hilbert spaces: The definition and some simple properties, Orthogonal complements, Orthonormal sets, The conjugate space H*

UNIT IV OPERATIONS ON HILBERT SPACES **12 Hrs**

Hilbert spaces (Continued): The adjoint of an operator, self-adjoint operators, Normal and unitary, projections.

UNIT V FINITE DIMENSIONAL SPECTRAL THEORY **12 Hrs**

Finite Dimensional spectral theory: Matrices Determinants and the spectrum of an operator, The spectral theorem.

Max Hrs: 60 Hrs

Course Outcome: At the end of the course, the student will be able to

CO1 Define Banach space and Hilbert space and list Examples.
CO2 Understand the Continuous linear functional, Hahn Banach theorem and open mapping theorem.
CO3 Solve the problem on continuous functional, imbedding theory and operations of Hilbert space.
CO4 Classify continuous functional, Natural imbedding, orthogonal set and orthonormal set .
CO5 Compare Hilbert space, Banach space, Matrices, Determinant and the spectrum of operators.
CO6 Develop geometry on Banach space and Hilbert space.

REFERENCE BOOKS:

1. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill, International Book company, 8th edition, 2004.
2. BalmohanV. Limaye, Functional Analysis, Fourth Edition, New Age International Pvt Ltd, 2014.
3. M. ThambanNair, Functional Analysis, A First Course, PHI, 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5303	SELF -PACED LEARNING: HISTORY OF MATHEMATICS	L	T	P	EL	C
		0	0	0	6	2

COURSE OBJECTIVES:

- To understand the origin of mathematics
- To understand the evolution of Algebra and calculus
- To analyze the algebra and number theory in real life application from ages.

UNIT I INTRODUCTION TO MATHEMATICS

The Ancient Greeks - Pythagoras - Introduction to Pythagorean Ideas - Euclid - Introduction to Euclid - Archimedes - The Genius of Archimedes-Zeno's Paradox and the Concept of Limit - The Context of the Paradox? - Consideration of the Paradoxes - Decimal Notation and Limits - Infinite Sums and Limits - Finite Geometric Series.

UNIT II INTRODUCTION TO ALGEBRA

The Arabs and the Development of Algebra - The Development of Algebra Al-Khowarizmi and the Basics of Algebra - The Life of Al-Khwarizmi - Omar Khayyam and the Resolution of the Cubic - Cardano, Abel, Galois, and the Solving of Equations - A Particular Equation - The General Case - The Brief and Tragic Lives of Abel and Galois - The Work of Abel and Galois in Context - Rene Descartes and the Idea of Coordinates - Introductory Remarks -The Life of Rene Descartes – The Real Number Line- The Cartesian Plane -Coordinates in Three- Dimensional Space.

UNIT III CALCULUS

The Invention of Differential Calculus - The Life of Fermat - Fermat's Method-Fermat's Lemma and Maximum/Minimum Problems - Complex Numbers and Polynomials - Progenitors of the Complex Number System - Cardano - Argand - Cauchy - Riemann - Complex Number Basics - The Fundamental Theorem of Algebra - Finding the Roots of a Polynomial - Cauchy and the Foundations of Analysis - Why Do We Need the Real Numbers?

UNIT IV NUMBER THEORY

The Prime Numbers - The Sieve of Eratosthenes - The Infinitude of the Primes - Dirichlet and How to Count - The Life of Dirichlet - The Pigeonhole Principle - Riemann and the Geometry of Surfaces - Introduction - Georg Cantor and the Orders of Infinity – Introductory Remarks - An Uncountable Set - Countable and Uncountable - The Existence of Transcendental Numbers.

UNIT V ABSTRACT ALGEBRA

Henri Poincare, Child Prodigy - Introductory Remarks - Emmy Noether and Algebra - The Life of Emmy Noether - Emmy Noether and Abstract Algebra: Groups - Emmy Noether and Abstract Algebra: Rings - The Idea of an Ideal - Cryptography - What is Cryptography?

Course Outcome: At the end of the course, the student will be able to

CO1	Recognizing the history of mathematics
CO2	Summarizing the work in algebra
CO3	Executing about complex numbers and calculus
CO4	Analyzing number theory
CO5	Experimenting abstract algebra
CO6	Designing cryptography and applying them in real time applications

REFERENCE BOOKS

1. StevenG.Krantz,An Episodic History of Mathematics,The Mathematical Association of America,2010.
2. C.B. Boyer and U. Merzbach, History of Mathematics, John Wiley & Sons, 3rd edition, 2011.
3. E.T.Bell, Men of Mathematics, Published by Simon& Schuster,1986.

SMTB5401	RESEARCH METHODOLOGY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To discuss the techniques and tools to be employed
- To develop skills in qualitative and quantitative data analyses and presentation
- To learn various statistical tools for solving real life problems.

UNIT I RESEARCH AND ITS ETHICS 12 Hrs

Research Project – Difference between a dissertation and a thesis– Basic requirements of a research degree –Writing a proposal –Ethical considerations

UNIT II LITREATURE REVIEW 12 Hrs

Different components of a research project– Literature review – Methodology – Results / data – Conclusions – Bibliography - Appendices.

UNIT III DISTRIBUTIONS 12 Hrs

The Gamma and Chi – Square distribution – The normal distribution.

UNIT IV TRANSFORMATIONS 12 Hrs

Transformation of variables – t & F distributions.

UNIT V MGF AND CENTRAL LIMIT THEOREM 12 Hrs

The MGF technique – Distributions of $\overline{X}$ and $\frac{ns^2}{\sigma^2}$ Expectations of functions of random variables-The Central Limit Theorem.

Max. Hrs: 60 Hrs

Course Outcome: At the end of the course, the student will be able to

CO1 Identify the basic requirements of research
CO2 Understand the different components of project
CO3 Use statistical distribution in research work
CO4 Analyze the research work using F and t distribution
CO5 Evaluate expectation of functions of random variable
CO6 Develop the idea of central limit theorem

TEXT/REFERENCE BOOKS:

1. Writing up your University Assignments and Research Projects – A Practical handbook, Neil Murray and Geraldine Hughes, McGraw Hill Open University Press.2008
2. Introduction to Mathematical Statistics, Fourth Edition, Robert V. Hogg and Allen T.Craig, Pearson Education Asia. 2013
3. Research Methodology (2nd revised methods and techniques edition)- C.R.Kothari, New Age International Publications, New Delhi. 2014
4. Fundamentals of Mathematics statistics-S.C.Gupta, V.K.Kapoor, Eleventh edition 2002,Sultanchand& sons Publishers, New Delhi.2020

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**

PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5402	FLUID DYNAMICS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To identify the fundamental kinematics of a fluid element.
- To prepare a foundation to understand the motion of fluid and develop concept, models and techniques.
- To apply the basic applied-mathematical tools that support fluid dynamics.

UNIT I KINEMATICS **12 Hrs**

Kinematics of fluid sin motion: Real fluids and ideal fluids, velocity of a fluid at a point, stream lines and path lines, Steady and unsteady flows. The velocity potential, The vorticity vector, Local and particle rates of change, The equation of continuity, worked examples, acceleration of a point of a fluid.

UNIT II MOTION OF A FLUID **12 Hrs**

Equations of motion of a fluid : pressure at a point in a fluid at rest, Pressure at a point in a moving fluid, Conditions at a boundary of two inviscidImmissible fluids, Euler's equations of motion, Bernoulli's equation, worked examples, Some flows involving axial symmetry, Some special two dimensional flows, Impulsive motion.

UNIT III TWO DIMENSIONAL FLOWS – I **12 Hrs**

Some two dimensional flows: Meaning of two dimensional flows, use of cylindrical polar coordinates, The stream function. The complex potential for two-dimensional irrotational, incompressible flow, complex velocity potential for standard two-dimensional flows, uniform stream, line sources and line sinks, line doublets, line vortices, worked examples.

UNIT IV TWO DIMENSIONAL FLOWS – II **12 Hrs**

Some two dimensional flows(Continued):Two dimensional image systems, The Milne Thomson circle theorem, some application of the circle theorem, extension of the circle theorem, the theorem of blasius, The use of conformal transformation–some hydrodynamical aspects of conformal transformation worked example, vortex rows–single infinite rows of line vortices, The karman vortex street.

UNIT V THREE DIMENSIONAL FLOWS **12 Hrs**

Some three dimensional flows: Introduction, sources, sinks and doublets, Image sinarigd infinite plane, Axi-symmetric flows, Stokes stream function, some special form of the stream function for axi-symmetric irrotational motions.

Max Hrs: 60 Hrs

Course Outcome: At the end of the course, the student will be able to

CO1 Define Real Fluids, Ideal Fluids, Streamlines, Pathlines, Vortex Lines, Source, Sinks, Doublets.

CO2 Derive Equation of Continuity, Eulers equation of motion, Bernoullis equation.

CO3 Apply Conditions at boundary of two inviscid Immiscible Fluid.

CO4 Analyze fluid motion under Steady & Unsteady Flow, Crompressible & Incompressible Fluid.

CO5 Evaluate the velocity potential, streamlines, pathlines, equi-potential surface, steam function.

CO6 Develop Stokes stream function and the flow characteristics.

TEXT/REFERENCE BOOKS:

1. F.Chorlton, Text book of Fluid Dynamics, CBS Publication and Distribution, 2004.
2. M.D.Raisinghania, Fluid Dynamics, S.Chand, 2008.
3. G.K.Batchelor, AnIntroduction to Fluid Mechanics, Foundation Books, 1984.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB5403	MATHEMATICS FOR RESEARCH	L	T	P	EL	0
		0	0	0	6	2

COURSE OBJECTIVES:

- To identify the fundamental concepts of counting principle .
- To prepare a foundation to understand Real and Complex analysiss.
- To apply the basic concepts of pure mathematics.

UNITI ALGEBRA

Groups–ACountingPrinciple-Homomorphism-AnotherCountingPrinciple-Sylow'stheorem–Ideals and Quotient rings – Polynomial Rings-The elements of GaloisTheory.

UNITII REALANALYSIS

Countable and Uncountable Sets -Metric Spaces -Cauchy Sequences –Series –Continuous functions -InfiniteLimitsandLimitsatInfinity-MeanValueTheorems-UniformConvergence-Power series.

UNITIII COMPLEXANALYSIS

Analytic Functions -Complex Integration - The integral formula - Zeroes and Poles – The Residue theorem -Evaluation of Definite Integrals-Power Series expansion.

UNITIV TOPOLOGY

Basis for a topology - Continuous functions - The Metric Topology – Connectedness andCompactness-TheCountabilityaxioms–TheSeparationaxioms-TheUrysohn lemma.

UNITV FUNCTIONALANALYSIS

Normed Linear Spaces - Continuity and Boundedness of Linear Mappings - Dual Spaces -Hahn-Banach Theorem - Dual of C [0,1] -The Open Mapping Theorem -Inner Product Space and Hilbert Space-Riesz Representation Theorem

TEXT/ REFERENCE BOOKS

1. I. N.Herstein,TopicsinAlgebra, Wiley Eastern Limited,NewDelhi,1992.
2. Walter Rudin, Principles of Mathematical Analysis, Third Edition, McGraw-Hill International Book Company, New York, 1976.
3. Lars V. Ahlfors, Complex Analysis: An Introduction to the Theory of Analytic Functions of One Complex Variable,Third Edition,Mac Millan Publishers India Delhi, 2013.
4. James R. Munkres, Topology, Second Edition, PHI Learning Pvt Ltd., New Delhi, 2009.
5. SS. C. Bose, Introduction to Functional Analysis, Mac Millan Publishers India, Delhi,1992.
6. Serge Lang, Algebra, Third Edition, Springer Graduate Texts in Mathematics, NewYork, 2002.
7. Tom M.Apostol, Mathematical Analysis, Addison-Wesley Publishing Company London, 1974.
8. S.Ponnusamy, Foundations of Complex Analysis, Second Edition, Narosa Publishing House, India,2005.
9. G. F. Simmons, Introduction to Topology and Modern Analysis, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2006.

SMTB3001	DISCRETE MATHEMATICS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- This course enables the ability to identify, reflect upon and evaluate
- To apply different types of information and knowledge to form independent judgments.
- To improves logical thinking of the students and apply in different areas.

UNIT I LOGIC **12 Hrs**

Statements and Notations, Connectives ,Negation, Conjunction, Disjunction, statement, Formulae and Truth Tables, Conditional and Bi-conditional, Well–formed Formulae, Tautologies, Equivalence of Formulae, Duality Law Tautological Implications.

UNIT II INFERENCE THEORY **12 Hrs**

Normal Forms, Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive Normal Forms, Principal Conjunctive Normal Forms, Rules of Inference, The Predeicate Calculus,.Predicates,Variables and Quantifiers, Predicate Formula, Free and Bound Variables.

UNIT III SEMIGROUP AND MONOID **12 Hrs**

Semi groups, Monoids, Homomorphism of Semi groups and Monoids, Sub semi groups and Sub monoid.

UNIT IV LATTICES **12 Hrs**

Lattices as Partially Ordered Set, Properties of Lattices, Lattices as Algebraic Systems, Sublattices, Direct Product and Homomorphism.

UNIT V BOOLEAN ALGEBRA **12 Hrs**

Boolean Algebra, Basic properties, Sub algebra, Direct Product, and Homomorphism, Boolean Functions.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Define truth table; list equivalent Propositions, List basic properties of Lattices and Boolean algebra. Identify semigroup and Monoid
CO2 Understand Equivalence Relation, Lagrange's theorem on cyclic group.
CO3 Solve problems on Inference theory for Propositional Calculus and Predicate Calculus.
CO4 Evaluate problems on implication and Equivanlence laws, Analyse Lattices as Algebraic system
CO5 Develop supremum and infimum in Boolean function, .
CO6 Construct direct product and Boolean function

TEXT / REFERENCE BOOKS

1. J.P.Trembley,R.Manohar, Discrete Mathematical Structures with applications to Computer science, Mc Grew Hill Book Co.,second edition 2001.
2. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, Prentice Hall of India, e-Book, 2013.
3. R.Lidland G.Pilz, Applied Abstract Algebra,Springer Verla,1984.
4. Ralph P. Grimaldi Discrete and combinatorial Mathematics An Applied Introduction, Fourth edition, Pearson Eduncation Asia,Delhi 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3002	TRANSFORM TECHNIQUES	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- This course gives opportunity to students to know the principles and concepts of Laplace Transforms, Fourier Transforms and Z-Transforms.
- To apply Laplace Transform to solve differential equations. Evaluate integrals using Laplace Transform and Fourier Transform.
- To form the difference equations and make use of the concepts of Z-Transforms to solve the difference equations.

UNIT I LAPLACE TRANSFORM **12 Hrs**

Laplace transform – Transforms of standard functions – properties– Transforms of derivatives and integrals – Transforms of the type $e^{at}f(t)$, $tf(t)$, $f(t)/t$ - Transform of periodic functions – Transform of unit step function and impulse function - Initial and final value theorems

UNIT II INVERSE LAPLACE TRANSFORM **12 Hrs**

Inverse Laplace transform –Transforms of standard functions – properties - Convolution theorem – Heaviside expansion theorem and its application.

.UNIT III APPLICATIONS OF LAPLACE TRANSFORM **12 Hrs**

Llinear ordinary differential equation with constant co-efficients – Integral equations - Integral equations of convolution type - simultaneous linear differential equations with constant co-efficients

UNIT IV FOURIER TRANSFORM **12 Hrs**

The infinite Fourier transform – Sine and Cosine transform – Properties – Inversion theorem – Convolution theorem – Parseval's identity – Finite Fourier sine and cosine transform.

UNIT IV Z-TRANSFORM **12 Hrs**

Z–transform and inverse Z-transform of elementary functions, Shifting theorems, Convolution theorem, Initial and final value theorem, Application of Z-transforms to solve difference equations.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Applying the concept of Laplace Transforms to various type of functions.
CO2 Illustrate the solution for the functions using inverse Laplace transforms.
CO3 Produce the solution for integral and differential equations using Laplace and inverse Laplace Transforms.
CO4 Evaluate the functions by using finite and infinite fourier transforms.
CO5 Implement the solution for various functions using z transforms and Inverse Z transforms.
CO6 Determine the solution of difference equations using z transforms and Inverse Z transforms.

TEXT/ REFERENCE BOOKS

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2011.
2. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, Narosa Publishing House, 2009.
3. F. B. Hildebrand, Methods of Applied Mathematics, Courier Dover Publications, 1992.
4. L. Debanth and D. Bhatta, Integral Transforms and Their Applications, 2nd Ed., Taylor and Francis Group, 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3003	GRAPH THEORY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- The study of graphs provides solution to problems in layout, networking, optimization, matching, and operation
- To apply the fundamental concepts in graph theory
- To apply principles and concepts in graph theory in solving practical problems.

UNIT I INTRODUCTION TO GRAPH THEORY **12 Hrs**

Graphs – Applications of graphs – finite and infinite graphs – Incidence and degree – Isomorphism Subgraphs – Walks, paths and circuits – connected graphs, disconnected graphs and components - Directed graph – some types of digraphs.

UNIT II EULERIAN AND HAMILTONIAN GRAPH **12 Hrs**

Euler Graphs – Operations on Graphs – More on Euler Graphs – Hamiltonian paths and circuits.

UNIT III TREES **12 Hrs**

Trees – some properties of Trees – Pendant vertices in a Tree – Distance and centers in a Tree – Spanning Trees – Spanning Trees in a weighted Graph**.**

UNIT IV OPTIMIZATION AND MATCHING **12 Hrs**

Cut–sets – some properties of cut–sets – All cut–sets in a Graph – Fundamental circuits and cut–sets – connectivity and separability - Matching theory – Hall's Marriage theorem.

UNIT V PLANAR GRAPH **12 Hrs**

Planar Graphs – Kuratowski's Graphs – Different representations of a planar Graph – Chromatic Number and chromatic polynomials.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List precise and accurate mathematical definition of objects in graph theory.
CO2 Interpret whether graphs are Hamiltonian and / or Eulerian.
CO3 Apply basic algorithm to find spanning trees in a weighted graph
CO4 Analyze problems involving vertex and edge connectivity, cut sets and matching.
CO5 Evaluate chromatic number and chromatic polynomial
CO6 Create different planar graph and apply some basic algorithms to use graph theory as a modeling graph

TEXT / REFERENCE BOOKS

1. NarsinghDeo, Graph Theory with applications to Engineering and Computer Science, Prentice Hall of India, Publications 2004.
2. AmitSinha, Suneet Gupta, Graph Theory, Acme Learning Private Limited, First Edition, e-book, 2012.
3. S. Arumugam and S. Ramachandran, Invitation to Graph theory, SciTech publications, 2015.
4. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer, Second Edition, 2012.
5. G. Suresh Singh, Graph Theory, PHI Learning, e-book, 2010.
6. UditAgarwal, Umesh Pal Singh, Graph Theory, University Science Press, 2009.

End Semester Exam Question Paper Pattern
Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 Marks each – No choice **20 Marks**
PART B : 2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3004	ASTRONOMY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To familiarize and appreciate the field of astronomy and its relation with various allied fields of Science viz., Physics, Biology, Chemistry, Mathematic, Geology, meteorology etc. as it is Multi disciplinary in nature.
- To understand the impact of astronomical bodies and formations on earth and climate.
- To familiarize with the basic principles and theories of new emerging area of astrophysics.

UNIT I SPHERICAL TRIGONOMETRY **12 Hrs**

Sphere–Great circles and small circles–axis and poles of a circle–Distance between two points on a sphere – angle between two circles – Secondaries – angular radius – length of an arc of a small circle – spherical triangle – cosine formula, sine formula, cotangent formula (without proof).

UNIT II CELESTIAL SPHERE **12 Hrs**

Celestial sphere–diurnal motion, celestial axis and equator–celestialhorizon – Zenith and Nadir – Celestial Meridian – Cardinal points – Declination circles – Verticals – Parallactic angle – Rising and setting – Transit or culmination – due east, west, north, south – annual motion of sun – First point of Aries and First point of Libra – Equinoxes and Solstices – Celestial coordinates – Horizontal, Equatorial, Meridian, ecliptic systems – Hour Angle and azimuth at rising and setting – latitude of a place – Circumpolar Star – Twilight.

UNIT III REFRACTION **12 Hrs**

Laws of refraction–Astronomical refraction–Tangent formula–General effects–Effects on rising or setting – Effect on R.A, declination – effect on small horizontal arc, vertical arc, any small arc – Cassini's Formula – Horizontal refraction. Concepts of geocentric, heliocentric parallax, aberration, Precession and Nutation (definitions only) Overview of the universe – The solar system in general – the other planets – comets – galaxies.Time: Equation of time–Seasons–Calendar–Conversion of time.

UNIT IV KEPLER'S LAWS AND PLANETARY PHENOMENA **12 Hrs**

Kepler's Laws of planetary motion –Longitude of Perigee–Forward motion ofthe apse line – eccentricity of earth's orbit – To fix the position of a planet in its elliptical orbit – To express v as a series of u- mean anomaly – Kepler's equation – To express u as a series in m. Phases of the planets–Relation between sidereal and synodic period ofa planet, brightness of the planets.

UNIT V MOON AND ECLIPSES **12 Hrs**

Relation between sidereal and synodic month–elongation–Phases of moon. Umbra and Penumbra–Lunar eclipse–Solar eclipse–Condition for occurrence of asolar eclipse – angular radius of the cross section of the shadow cone where moon enters – length of earth's shadow – condition for the occurrence of a solar eclipse – ecliptic limits – maximum and minimum number of eclipses near a node - in a year – Saros of Chaldeans.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the origin of the universe, the big bang theory and the present general structure of the universe.
CO2 Discuss the components and facts of the solar system.
CO3 Sketch the methods use to explore the natural phenomena of the universe.
CO4 Analyze the nature of planets including planets formation and evaluation.
CO5 Summarize the science of cosmology and its relation to the other fields of science.
O6 Organize how the scientific method and quantitative arguments are used in cosmology.

TEXT / REFERENCE BOOKS

1. S. Kumaravelu and SusheelaKumaravelu, Astronomy. SKV Publishers, Nagarkoil, 2004.
2. V.Thiruvenkatacharya, A text book of Astronomy, SChand& Co. Pvt. Ltd., 1972.
3. H.Kartunen, Fundamental Astronomy, Content Technologies Publications, 2013.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3005	NUMBER THEORY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To present a rigorous development of Number Theory using axioms, definitions, examples, theorems and their proofs.
- To identify various properties relating to the integers
- To apply the Well-Ordering Principle, primes, unique factorization, the division algorithm and greatest common ivisors.

UNIT I EUCLIDEAN ALGORITHM AND DIOPHANTINE EQUATION 12 Hrs

The Division Algorithm – The g.c.d. – The Euclidean Algorithm – The Diophantine Equation ax + by = c.

UNIT II THE SIEVE OF ERATESTHENES 12 Hrs

The Fundamental theorem of arithmetic , The sieve of Eratesthenes – The Goldbach conjecture – basic properties of congruence.

UNIT III FERMAT'S THEOREM 12 Hrs

Special Divisibility tests – Linear congruences – The Little Fermat's theorem – Wilson's theorem.

UNIT IV NUMBER THEORETIC FUCNTIONS 12 Hrs

The random functions – The Mobius inversion formula – The greatest integer function.

UNIT V EULER'S GENERALIZATION OF FERMAT'S THEOREM 12 Hrs

Euler's Phi – function – Euler's theorem – Some properties of the Phi – function.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Identify Euclid's algorithm to find the GCD.
CO2 Explain Sieve of Eratosthenes to find all prime numbers upto any given limit.
CO3 Apply Fermats little theorem to compute powers of integers modulo prime numbers.
CO4 Analyze Mobius inversion formula for counting the number of reduced fractions.
CO5 Appraise Euler's theorem in powers of integers modulo positive integers.
CO6 Investigate the number of non-negative *integers* less than n using Euler's Phi function

TEXT / REFERENCE BOOKS

1. David M. Burton, Elementary Number Theory, Universal Book Stall, 2001.
2. T.M. Apostol, Introduction to Analytic Number Theory, Springer Valley,1976.
3. Kumaravelu and Suseela Kumaravelu, Number Theory, SKV Publications, 2002.
4. Kenneth &Rosen, Elementary number theory & its applications, Addison Wesley Publishing Co. Ltd.,1968.
5. George E, Andrea, Number Theory, Hindustan Publishing,1989.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3006	COMBINATORICS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To familiar with fundamental combinatorial structures that naturally appear in various other fields of mathematics and computer science.
- To learn how to use these structures represent mathematical and applied questions.
- This course is an important skill for students interested in careers in analysis, engineering, design and the Sciences.

UNIT I BASICS **12 Hrs**

Basic combinatorial numbers – Stirling numbers of the second kind

UNIT II FUNCTION AND RELATION **12 Hrs**

Generating functions and Recurrence relations- Symmetric functions

UNIT III PRINCIPLE OF INCLUSION AND EXCLUSION **12 Hrs**

Multinomial - Multinomial theorem - Inclusion and Exclusion principle.

UNIT IV PERMUTATION AND COMBINATION **12 Hrs**

Euler function-Permutations with forbidden positions-The Menage problem-Problem of Fibonacci

UNIT V POLYA THEORY OF COUNTING **12 Hrs**

Polya Theory-Necklace problem and Burnside's Lemma- Cycle index of a permutation group- Polya's theorem and their immediate applications.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Recall the basic concepts of Combinatorics
CO2 Classify the function and relation, also illustrate problems using recurrence relation.
CO3 Sketch multinomial theorem and prepare inclusion and exclusion principle.
CO4 Analyze the problems of permutation and combination and to explain the concepts of arrangements with forbidden
CO5 Determine the number of distinct items using Polya's theorem on counting.
CO6 Create number of necklace with n clear and solid beads.

TEXT / REFERENCE BOOKS

1. V. Krishnamoorthy, Combinatorics theory and applications, East-west Press, 1985:
2. V.K. Balakrishnan, Theory and problems of combinatorics Schaum's outline series- Mcgraw Hill, 1994.
3. Inn Anderson, Combinatorics of finite sets, Oxford Science Publications kenneth P Boggart, Introductory Combinatorics- Pitmann Books Ltd, 2011.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3007	CRYPTOGRAPHY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- This course facilitate the students to improve knowledge and skills of standard concepts in cryptography
- To exhibit how cryptography plays an significant role in the present digital world
- To know encryption and decryption techniques and secure data in transit across data networks.

Unit I Introduction to Number Theory **12 Hrs**

Finite Fields and Number Theory: Modular arithmetic, Euclidian Algorithm, Primality Testing: Fermats and Eulers theorem, Chinese Reminder theorem, Discrete Logarithms

Unit II Cryptography and its Techniques **12 Hrs**

Overview of Cryptography, Computer security concepts, Security attacks, Symmetric cipher model, Cryptanalysis and brute-force attack, Substitution techniques, Caesar cipher, Mono alphabetic ciphers, Play fair cipher, Hill cipher, Poly alphabetic ciphers, One-time pad, Transposition techniques, Binary and ASCII.

Unit III Data Encryption Standard (DES) **and Advanced Encryption Standard** (AES) **12 Hrs**

Pseudo-random bit generation, Stream ciphers and Block ciphers and the Feistal cipher. The data encryption standard (DES), DES example, advanced encryption standard (AES), AES transformation functions, AES key expansion, AES example.

Unit IV Public-key Cryptography **12 Hrs**

Principles of public-key cryptosystems, The RSA algorithm and security of RSA, Elliptic curve arithmetic, Elliptic curve cryptography, Cryptographic Hash functions, Secure Hash algorithm, Message Authentication, Message Authentication Code (MAC).

Unit V Digital Signatures and Network Security **12 Hrs**

Digital signatures, Elgamal and Schnorr digital signature schemes, Digital signature algorithm. Wireless network and mobile device security, Email architecture, formats, threats and security, Secure/Multipurpose Internet Mail Extension (S/MIME) and Pretty Good Privacy (PGP).

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Understand the fundamentals of Cryptography including data and advanced encryption standard

CO2 Classify Encryption and decryption messages using block ciphers, sign and verify messages using well known signature generation and verification algorithms.

CO3 Identifying Authentication functions, the manner in which Message Authentication Codes and Hash Functions works.

CO4 Analyze Key Management techniques and importance of number Theory.

CO5 Developing knowledge of standard algorithms that can be used to provide confidentiality, integrity and authentication of data.

CO6 Design a security solution for a given application.

Text/ Reference Books

1. Stallings, William. Cryptography and Network Security, Principles and Practice (7th ed.). Pearson Education Limited. England. 2017
2. Trappe, Wade & Washington, Lawrence C. Introduction to Cryptography with Coding Theory (2nd ed.). Pearson Education International. 2006
3. Stinson, Douglas R. Cryptography Theory and Practice (3rd ed.). CRC Press. 2005
4. William Stallings Cryptography and Network Security: Principles and Practice, 4th edition, Pearson Education, India. 2006.
5. AtulKahate , Cryptography and Network Security, 2nd edition, Tata McGrawhill, India. 2008.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3008	FORMAL LANGUAGE AND AUTOMATA THEORY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVE

- To study formal languages and Automata and to establish some of the properties of such systems.
- To familiarize the students with some theories of Mathematics in Computer Science
- To define the grammar of programming languages and formalized versions of subsets of natural languages

UNIT I FORMAL LANGUAGES **12 Hrs**

Finite Automaton-Definition of finite automaton - Representation of finite automaton- Acceptability of a string by a finite automaton- Languages accepted by a finite automaton.

UNIT II FINITE AUTOMATA **12 Hrs**

Non-deterministic finite automaton- Acceptability of a string by NFA- Equivalence of FA and NFA- Procedure for finding an FA equivalent to a given NFA- Properties of regular sets –Decision algorithm for regular sets.

UNIT III GRAMMARS **12 Hrs**

Phrase – Structure Grammar derivations - Phrase–Structure languages – Context-sensitive languages (CSL)- Context-free languages(CFL)- Chomskian Hierarchy.

UNIT IV PROPERTIES OF REGULAR LANGUAGE **12 Hrs**

Closure Operation - Kleene Closure - Substitutions – Homomorphism - Inverse Homomorphism - Context free language, Derivation trees - Ambiguity leftmost, rightmost derivations.

UNIT V MORE PROPERTIES OF REGULAR LANGUAGE **12 Hrs**

Normal forms- Chomsky's normal forms- Problems based on Chomsky's normal forms – uvwxy theorem- Problems based on uvwxy theorem.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the languages and strings. Define finite automata.

CO2 Explain the concepts of finite automation and Non-deterministic finite automaton.

CO3 Illustrate the process of phrase- structure grammar..

CO4 Examine the decision algorithms for context free languages.
C05 Evaluate the problems based on Chomsky's normal forms

CO6 Formulate uvwxy theorem and problems based on uvwxy theorem

TEXT / REFERENCE BOOKS

1. Dr. M. Venkatraman, Dr. N. Sridharan, N. Chandrasekaran," Discrete Mathematics", Vikas Publishing House, 2004, Chapter 12, Sections 1 to 12.
2. Rani Siromoney, Formal Languages and Automata, The Christian Literature Society, 1984. Chapter 2, Sections 2.1 to 2.4, Chapter 3, Sections 3.1 to 3.2, Chapter 4, Sections 4.1 to 4.5.
3. John E Hopcroft, Jeffery D, Ullman, Introduction to Automata Theory and Computations, Narosa Publishing House, 2008.
4. Ragade B.R, "Automata and Theoretical Computer Science", Pearson Education, 2004.
5. Bernard M. Moret, " The Theory of Computation", Pearson Education, 2002.
6. Peter Linz,"An Introduction to Formal Languages and Automata", Jones& Bartlett Publishers, 2016.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3009	FINANCIAL MATHEMATICS	L	T	P	EL	C
		3	2	0	0	4

- **OURSE OBJECTIVES:**
- The objective of this course is to develop understanding on the concepts associated with financial mathematics
- To comprehend practical applications of interest rate in real life situation
- To develop technology skills, an in-depth understanding of advanced economics concepts

UNIT I PROBABILITY **12 Hrs**

Probability – Probabilities and Events – Conditional probability – Random Variables and Expected Values – Convergence and correlation – Continuous Random variables –Normal Random Variables – Properties of Normal Random Variables – The central limit Theorem – Simple Problems.

UNIT II GEOMETRIC BROWNIAN MOTION **12 Hrs**

Geometric Brownian Motion – G.B.M. as a limit of simple models – Brownian Motion – Simple problems - Interest rates – Present value analysis – Rate of return – Continution of varying interest rates – An example of option pricing – other examples of pricing via arbitrage.

UNIT III THE ARBITAGE THEOREM AND BLACK SCHOLES FORMULA **12 Hrs**

The Arbitage theorem – The multi period Binomial model – proof of the Arbitrage theorem - Black Scholes formula – properties of the Black Scholes option cost – Derivation of Black Scholes formula – simple problems.

UNIT IV ADDITIONAL RESULTS ON OPTIONS **12 Hrs**

Additional results on options – Call options on Dividend paying Securities – Pricing American put options – Adding Jumps to Geometric Brownian Motion – Estimating the Volatility Parameter – Simple problems.

UNIT V VALUING BY EXPECTED UTILITY **12 Hrs**

Valuing by Expected Utility – Limitation of Arbitrage pricing – valuing Investments by Expected utility – The portfolio selection problem – Value at risk and conditional value at risk The capital assets pricing model – Mean variance analysis of risk – Neutral priced Call options – Rates of return – Single period and Geometric Brownian Motion – simple problems.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify and approximate probability distribution for a given discrete or continuous random variable and use its properties to calculate probabilities.
CO2	Relate the continuous time stochastic process using geometric Brownian motion.
CO3	Apply black scholesformula in financial market, which contains derivative investment instruments. Construct Arbitrage theorem to help the investors and financial analyst in price securities
CO4	Analyze the stock prices, prices of other assets caused by unpredictable events using jumps to geometric Brownian motion.
CO5	Evaluate the expected utility by taking the weighted average of all possible outcomes under certain circumstances.
CO6	Compose the invariance principle that a decision maker should not be affected by the way alternates are presented.

TEXT / REFERENCE BOOKS

1. Sheldon .M.Ross, An Elementary Introduction to Mathematical Finance, 2nd Edition, Cambridge University press, 2005.
2. S.M.Ross, A first course in probability, Englewood cliffs Prentice Hall-NJ, 2002.
3. J.Cox and M.Rubinstein, Options Market, Englewood cliffs Prentice Hall-NJ, 2012.
4. J.E.Ingersill, Theory of financial decision making, Lanjarn, MD Rowerman of Little fields, 1987.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB3010	ACTUARIAL MATHEMATICS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To learn and gain the knowledge about the impact of economic and social conditions in the financial sector.
- To create awareness about the financial terminology and calculations in the policy designing.
- To define, analyze, and solve the financial implications of uncertain future events

UNIT I LIFE INSURANCE **12 Hrs**

Introduction to life insurance - Insurance Payable at the Moment of Death- Insurance Payable at the End of Year of Death - Relationship between Insurance Payable at the Moment of Death and End of the Year of Death.

UNIT II LIFE ANNUITIES **12 Hrs**

Introduction to Life Annuities - Continuous Life Annuities - Discrete Life Annuities - Life Annuities with monthly Payments - Complete Annuities-Immediate and Apportion able Annuities-Due.

UNIT III GENERAL INSURANCE FOR BUSINESS **12 Hrs**

Describe the general insurance business environment Current business environment - Main provider of general insurance - Main types of general insurance Purposes - Benefits and perils- Exposure to which premiums are related - Claim characteristics - Risk factors and risk rating

UNIT IV OCCUPATIONAL PENSION PROVISION **12 Hrs**

Occupational pensions scheme – main features, advantages and disadvantages, occupational pension scheme and personal pension - Defined benefit occupational pension schemes (state provisions, advantages and disadvantages)

UNIT V BONDS AND OTHER SECURITIES **12 Hrs**

Premium and Discount - Valuation between Coupon Payment Dates - Determination of Yield Rates - Callable and Putable Bonds - Serial Bonds.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Demonstrate an appropriate mastery of theory and techniques

CO2 Identify appropriate techniques based on theory and practice in Annuties.

CO3 Apply general insurance policy in business environment and exposure main types of general insurance

CO4 Analyse the benefits of occupational pension

CO5 Evaluate the quantitative data in premium and securities and performing calculations

CO6 Create a data sheet for bonds and securities

TEXT BOOKS/REFERENCES:

1. Neelam CGulati, Principles of Insurance Management, Excel Books, New Delhi. 2012.
2. Harriett EJones, Principles of Insurance FLM IInsurance EducationProgram. Life Management Institute LOMA, Dec 1995.
3. Gerber,HansU, Life insurance mathematics 3rd Edition–Springer.Swiss Association of Actuaries,1997.
4. Chandra, P., Investment Analysis and Portfolio Management, 4th Edition, Tata McGraw-Hill Education, New Delhi, 2012.
5. Ranganathan, M. and Madhumathi,R., Security Analysis and Portfolio Management, 2nd Edition, Pearson, New Delhi, 2012.
6. Gupta P. K., Insurance and risk management, HPH, 2nd edition, 2018.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB7001	ALGEBRAIC NUMBER THEORY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To prove theorems about integrals bases
- To develop unique factorization into ideals
- To solve Diophantine equations.

UNIT I EUCLIDEAN ALGORITHM 12 Hrs

Divisibility theory in the integers – the division algorithm, the greatest common divisor, the Euclidean algorithm, the Diophantine equation ax + by = c. Primes and their distribution. The fundamental theorem of arithmetic. The sieve of Eratosthenes. The theory of congruences. Basic properties of congruence. Binary and decimal representation of integers. Linear congruences and Chinese remainder theorem.

UNIT II FERMAT'S LITTLE AND WILSON'S THEOREM 12 Hrs

Fermat's little theorem and pseudo primes Wilson's theorem. The sum and number of divisors. The greatest integer function. Euler's phi-function. Euler's generalization of Fermat's theorem. Properties of the phi-function.

UNIT III INNER PRODUCT SPACES 12 Hrs

Basic concepts Vector Spaces - linear independence and bases – Inner product spaces – Characteristic roots and matrices of a linear transformation

UNIT IV LINEAR HOMOGENEOUS EQUATIONS 12 Hrs

System of linear homogeneous equations. Null space and nullity of matrix. Sylvester's law of nullity. Range of a matrix. Systems of linear non homogeneous equations. Characteristic roots and characteristic vectors of a square matrix.

UNIT V HERMITIAN AND UNITARY MATRICES 12 Hrs

Some fundamental theorem. Characteristic roots of Hermitian, Skew Hermitian and Unitary matrices. Characteristic equation of a matrix Cayley - Hamilton theorem.

Max Hrs: 60 Hrs

Course Outcome: At the end of the course, learners would acquire competency in the following skills.

CO1 Recall divisibility property of integers, distribution of prime numbers.
CO2 Identify Fermat's little theorem, Wilson's theorem and their application to simple problems.
CO3 Understand number theoretic function and their properties.
CO4 Apply Elementary transformation and their application in solving problems.
CO5 Analyze matrix representation of homogeneous and non-homogeneous equations.
CO6 Create Characteristic equation and roots of a complex matrix.

REFERENCE BOOKS

1. David M. Burton, Elementary Number Theory, Sixth Edn., TMH. 2005
2. Shanti Narayanan & Mittal, A Text Book of Matrices, Revised edn., S. Chand. 2010
3. C.Y. Hsiung, Elementary Theory of Numbers. Allied Publishers.1986
4. Neville Robbins, Beginning Number Theory, Second Ed. Narosa.1996
5. George E. Andrews, Number Theory, HPC. 1998
6. Kenneth Hoffman & Ray Kunze : Linear Algebra, Pearson Education. 2000

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB7002	FUZZY ANALYSIS	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To develop the fundamental concepts such as fuzzy sets, operations and fuzzy relations.
- To learn about the fuzzification of scalar variables and the defuzzification of membership functions.
- To learn three different inference methods to design fuzzy rule based system.

UNIT I FROM CLASSICAL SETS TO FUZZY SETS 12 Hrs

Fuzzy set: Basic types and Basic concepts–Fuzzy sets VersusCrisp sets: Extension Principle for fuzzy sets.

UNIT II FUZZY ARITHMETIC 12 Hrs

Fuzzy numbers-Linguistic variables–Arithmetic operations on intervals– Arithmetic operations on Fuzzy numbers–Lattice of Fuzzy numbers –Fuzzy equations.

UNIT III FUZZY LOGIC 12 Hrs

Fuzzy Propositions–Linguistic Hedges–Inference from conditional Fuzzy propositions – Inference from conditional and qualified propositions.

UNIT IV FUZZY DECISION MAKING 12 Hrs

Individual decision making–Fuzzy Ranking methods–Fuzzy Linear programming.

UNIT V FUZZY RELATIONS 12 Hrs

Fuzzy Relations - Binary Fuzzy Relations – Binary Relations on a Single Set- Fuzzy Equivalence Relations.

Max Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Define the fuzzy set and list the various operations on fuzzy set.
CO2 Give examples for linguistic variables
CO3 Explain arithmetic operations on intervals, fuzzy numbers with examples
CO4 Distinguish different type of fuzzy proposition with example
CO5 Evaluate fuzzy ranking method for individual decision making and group decision making.
CO6 Construct the composition of fuzzy relation and develop the properties of fuzzy relation

REFERENCE BOOKS:

1. George J. Klirand Bo Yuan, Fuzzy sets and Fuzzy Logic Theory and Applications,PHI, 2004.
2. A.NagoorGaniand V.J.Chandrasekaran, A first look at Fuzzy Graph Theory, Allied Publishers Pvt. Ltd. 2000
3. Timothy J.Ross, Fuzzy Logic with Engineering Applications–McGraw-Hill,Inc., 2001
4. H.J.Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers Limited, 1991.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB7003	ADVANCED GRAPH THEORY	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To understand and apply the fundamental concepts in graph theory.
- To formulate and prove central theorems about trees, matching, connectivity, coloring and planarity of graphs.
- To apply theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.

UNIT I GRAPHS AND DIGRAPHS 12 Hrs

Elementary Concepts of Graphs and Digraphs , Graphs - Degree sequences - Connected graphs and Distance -Digraphs and Multigraphs - Cut vertices - Bridges - Blocks - Automorphism group of a graph.

UNIT II TREES 12 Hrs

Trees and Networks: Trees, cut edges and bonds, cut vertices, Cayley Formula, the maxflow min-cut theorem, connectivity, blocks. The Connector problem, variousMenger's theorem.

UNIT III EULER AND HAMILTONIAN GRAPHS 12 Hrs

Euler and Hamiltonian Paths. Necessary and sufficient conditions for Euler circuits and paths in simple, undirected graphs. Hamilton city: noting the complexity of hamiltonicity, Traveling Salesman's Problem, Nearest neighbor method.

UNIT IVPLANARITY AND CONNECTIVITY 12 Hrs

Planarity in graphs, Euler's Polyhedron formula. Kuratowski'stheorem . Vertex connectivity, Edge connectivity, covering, Independence.

UNIT V MATCHINGS AND COVERINGS 12 Hrs

Matching in Bipartite graphs, perfect matching. The personnel Assignment problems, The Optimal assignment problems. Colorings: Edge chromatic number, Coloring of Chordal graph, Class-1 graphs, Class-2 graphs, Vizing's theorem, Brook's theorem

Max Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Define cut vertices, Blocks, connectedness, matching, covering, and coloring in graphs

CO2 Explain the relation between independence number and covering number in a graph. Explain Euer and Hamiltonian graphs

CO3 Evaluate Mengers theorem on Connectedness Berge theorem on Matching. Chromatic number of Chordal graphs,

CO4 Compare Connectivity and connectedness in graphs and maximum matching and minimum matching in a graph. Hence deduce a relation between the parameters.

CO5 Evaluate Chromatic number , covering , independent number of various graphs

CO6 Create a Characterization for 2- connectedness in graphs, matchings in Bipartite graphs.

REFERENCE BOOKS

1. Bondy, J. A. and Murty, U.,S.,R., Graph Theory with Applications, North Holland Publication 2000.
2. M.Murugan, Topics in Graph theory and Algorithms, Muthali Publishing House, First Edition, 2003.
3. NarasinghDeo, Graph Theory with application to Engineering and Computer Science, Prentice Hall India, 2010.
4. S.A.Choudum, Graph Theory, Macmillan India Limited, 2020.
5. F.Harary, Graph Theory, NarosaPublishing House, 2001.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB7004	FUZZY SETS , LOGIC THEORY AND APPLICATION	L	T	P	EL	C
		3	2	0	0	4

COURSE OBJECTIVES:

- To introduce the theory of fuzzy sets.
- To discuss theoretical differences between fuzzy sets and classical sets.
- To discuss fuzzy logic inference

UNIT I FUZZY SET **12 Hrs**

Classical sets: Operations and properties of classical sets, Mapping of classical sets to the functions. Fuzzy sets - Membership functions, Fuzzy set operations, Properties of fuzzy sets.

UNIT II FUNDAMENTALS OF FUZZY LOGIC **12 Hrs**

Classical and Fuzzy relations: Cartesian product, crisp relations-cardinality, operations and properties of crisp relations. Fuzzy relations-cardinality, operations, properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations, value assignments and other format of the composition operation.

UNIT III FUZZIFICATION AND DEFUZZIFICATION **12 Hrs**

Features of the membership functions, various forms, Fuzzification, Defuzzification to crisp sets, - cuts for fuzzy relations, Defuzzification to scalars. Fuzzy logic and approximate reasoning, Other forms of the implication operation..

UNIT IV FUZZY SYSTEMS **12 Hrs**

Natural language, Linguistic hedges, Fuzzy (Rule based) System, Aggregation of fuzzy rules, Graphical techniques of inference, Membership value assignments: Intuition, Inference, rank ordering, Fuzzy Associative memories

UNIT V FUZZY CLASSIFICATION **12 Hrs**

Classification by equivalence relations-crisp relations, Fuzzy relations, Cluster analysis, Cluster validity, C-Means clustering, Hard C-Means clustering, Fuzzy C-Means algorithm, Classification metric, Hardening the Fuzzy C-Partition

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 Interpret Fuzzy Set Theory And Uncertainty Concepts

CO2 Identify The Similarities And Differences Between Probability Theory

CO3 Evaluate Fuzzy Set Theory And their Application Conditions

CO4 Apply Fuzzy Set Theory In Modeling And Analyzing Uncertainty In A Decision Problem

CO5 Apply Fuzzy Control By Examining Simple Control Problems

CO6 Evaluate The Fuzzy Classification Problems With Examples

TEXT / REFERENCE BOOKS

1. Timothy J.Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley,2010.
2. George J.KlirBo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi, 2009.
3. S. Rajasekaran, G.A.Vijayalakshmi - Neural Networks and Fuzzy logic and Genetic Algorithms, Synthesis and Applications, PHI, New Delhi,2003.
4. Michal Baczynski and Balasubramaniam Jayaram, Fuzzy Implications, Springer Verlag, Heidelberg, 2008

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 Marks each – No choice **20 Marks**
PART B : 2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**

SMTB7005	MATHEMATICAL MODELING	L	T	P	EL	C
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COURSE OBJECTIVES:

- To identify the significance of Mathematical Modeling and the various types of Mathematical models applied in different fields.
- To apply the models in various real life applications.
- To work with engineers and scientists to solve real-world problems.

UNITI INTRODUCTION **12 Hrs**

Basic Steps of Mathematical Modeling, its needs, types of models, limitations, Elementary ideas of dynamical systems, Equilibrium point, node, saddle point, focus, centre and limit-cycle idea with simple illustrations and figures

UNIT II POPULATION MODELS **12 Hrs**

Basic concepts, Exponential growth model, formulation , solution, interpretation and limitations. Compensation and depensation, Logistic growth model, formulation, solution, interpretation and limitations.

UNIT III EPIDEMIC MODELS **12 Hrs**

Basic concepts, SI model, SIS model with constant coefficient, SIS model with coefficient as a function of time t, SIS model with constant number of carriers, SIS model when the carriers is a function of time t, SIR model, Epidemics with vaccination.

UNIT IV ECONOMIC MODELS **12 Hrs**

Production and supply functions, price-elasticity, utility of consumption and consumer surplus, theory of production, production function**.**

UNIT V BIOLOGICAL MODELS **12 Hrs**

Blood flow and oxygen transfer Modeling blood flow, viscousity, Poiseuille law, mathematical formulation of the problem, solution and interpretation.

Max. Hrs: 60 Hrs

Course Outcomes: At the end of the course, the student will be able to:

CO1 List the origin of Mathematical Modeling, needs and limitations
CO2 Discuss the components and facts of various Population models.
CO3 Sketch the models used to explore the epidemics
CO4 Analyze the nature of the Economic models
CO5 Summarize the science of blood flow and oxygen transfer
CO6 Organize how the Poiseuille law is applied for modeling biological flows

TEXT / REFERENCE BOOKS

1. Mark M. Meerschaert, Mathematical Modeling, Academic Press, New Work, 1993
2. W. Meyer , Concepts of Mathematical Modeling, McGraw Hill, New York, 1994
3. Beltrami , Mathematics for Dynamic Modeling, Academic Press, Orlando, Florida, 1987
4. N. Bailey, The Mathematical Theory of Infectious Diseases, Haftier press, New York, 1975

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration: 3 Hrs.**

PART A :10 questions of 2 Marks each – No choice **20 Marks**
PART B :2 questions from each unit of internal choice, each carrying 16 Marks **80 Marks**