



SWARNANDHRA COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)
Accredited by NBA, AICTE, NEW DELHI • Accredited by NAAC with "A" Grade – 3.32/4.00 CGPA
Recognized by UGC Under Sections 2(f) & 12 (B) of UGC Act 1956
Approved by AICTE, New Delhi, Permanent Affiliated to JNTU K, Kakinada
Seetharampuram, NARSAPUR-534 280, W.G-Dist., Andhra Pradesh

DEPARTMENT OF S & H

TEACHING PLAN

Course Code	Course Title	Year/ Semester	Branch	Contact Periods/ Week	Academic Year	Date of Commencement of Semester
23BS3T02	COMPLEX VARIABLES & RANDOM PROCESS	II/III	ECE	60/6	2025-26	14-07-2025

Course Outcomes: After successful completion of this course, students should be able to:

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| 1 | CO1: apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (K3) |
| 2 | CO2: evaluate the Taylor's and Laurent's expansions of simple functions, determine the nature of the singularities and calculate residues to evaluate certain integrals (K3) |
| 3 | CO3: Apply different types of distribution functions like Binomial, Poisson, Uniform, Normal (K3) |
| 4 | CO4 : apply Marginal, Conditional and Joint Probability Distributions (K3) |
| 5 | CO5: Apply Stochastic process (K3) |

Unit	Outcome/ Bloom's Level	Topic s No.	Topics/Activity	Text Book/ Reference	Contac t Hour	Delivery Method
1	CO1:Students are able to apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (K3)	UNIT I: Functions of a complex variable and Complex integration				
		1.1	Introduction	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.2	Continuity, limit	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.3	Differentiability	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.4	Analyticity	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.5	Cauchy – Riemann Equations in Cartesian Co-Ordinates ,related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.6	Cauchy – Riemann Equations in Polar Co-Ordinates, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.7	Harmonic functions and Conjugate harmonic functions	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.8	Milne- Thompson Method, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.9	Complex integration: Line integral	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.10	Cauchy's Integral Theorem (without proof) ,related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.11	Cauchy's integral formula (without proof), related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		1.12	Generalized integral formula(without proof), related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB

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2	CO2: Students are able to evaluate the Taylor's and Laurent's expansions of simple functions, determine the nature of the singularities and calculate residues to evaluate certain integrals (K3)	UNIT II: Series expansions and Residue Theorem				
		2.1	Radius of convergence	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.2	Expansion in Taylor's series , related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.3	Problems on Taylor's series	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.4	Maclaurin's series, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.5	Laurent's series, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.6	Problems on Residue theorem	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.7	Types of Singularities: Isolated , Essential singularities	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.8	Pole of order m, Residues, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.9	Residue theorem (without proof), related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.10	Problems on Residue theorem	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.11	Evaluation of real integral of the type $\int_0^{\infty} x dx$,related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		2.12	Evaluation of real integral of the type $\int_0^{2\pi} \cos\theta, \sin\theta d\theta$. related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
3	CO3: Apply different types of distribution functions like Binomial, Poisson, Uniform, Normal (K3)	UNIT III: Probability & Random Variables				
		3.1	Probability through sets and relative frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.2	Events, probability definitions and Axioms	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.3	Joint Probability, Conditional Probability, Total Probability	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.4	Independent Events, Bayes' Theorem, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.5	Random variables (discrete and continuous)	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.6	Probability density functions, properties	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.7	Mathematical expectation	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.8	Mixed random variable, distribution and density functions, Properties	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.9	Binomial distribution, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.10	Poisson distribution, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB
		3.11	Uniform distribution, related problems	T ₁ ,R ₁ ,R ₂	1	PPT,BB

4	distributions (K3)	4.4	Chebyshev's inequality, related problems	T_2, R_2, R_3	1	12	PPT, BB
		4.5	Moment generating function	T_2, R_2, R_3	1		PPT, BB
		4.6	Characteristic function	T_2, R_2, R_3	1		PPT, BB
		4.7	Multiple Random Variables: Vector Random Variables	T_2, R_2, R_3	1		PPT, BB
		4.8	Joint Distribution Function, Properties of Joint Distribution	T_2, R_2, R_3	1	13	PPT, BB
		4.9	Marginal Distribution Functions	T_2, R_2, R_3	1		PPT, BB
		4.10	Conditional Distribution and Density—Point Conditioning	T_2, R_2, R_3	1		PPT, BB
		4.11	Interval conditioning, related problems	T_2, R_2, R_3	1		PPT, BB
		4.12	Statistical Independence, related problems	T_2, R_2, R_3	1		PPT, BB
UNIT V: Stochastic Processes-Spectral Characteristics							
5	CO5: Students are able to apply Stochastic process (K3)	5.1	Introduction to stochastic process	T_2, R_2, R_3	1	12	PPT, BB
		5.2	The Power Spectrum and its Properties	T_2, R_2, R_3	1		PPT, BB
		5.3	Properties of power spectrum	T_2, R_2, R_3	1		PPT, BB
		5.4	Auto correlation function	T_2, R_2, R_3	1		PPT, BB
		5.5	Relation between Power Spectrum and Auto correlation function	T_2, R_2, R_3	1		PPT, BB
		5.6	The Cross-Power Density Spectrum	T_2, R_2, R_3	1		PPT, BB
		5.7	Properties of Cross-Power Density Spectrum	T_2, R_2, R_3	1		PPT, BB
		5.8	Cross-Correlation Function	T_2, R_2, R_3	1		PPT, BB
		5.9	Relationship between Cross-Power Spectrum and Cross-Correlation Function.	T_2, R_2, R_3	1		PPT, BB
		5.10	Introduction to Spectral characteristics of system response	T_2, R_2, R_3	1		PPT, BB
		5.11	power density spectrum of response	T_2, R_2, R_3	1		PPT, BB
		5.12	cross power spectral density of input and output of a linear system	T_2, R_2, R_3	1		PPT, BB
Cumulative Proposed Periods						60	

Text Books:

S. No.	Authors, Book Title, Edition, Publisher, Year of Publication
1	B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2012.
2	Peytoon Z peebles, Probability, Random variables & Random Signal Principles, TMH, 4 th Edition 2001.

Reference Books:

S. No.	Authors, Book Title, Edition, Publisher, Year of Publication
1	Bruce Hajek - Random Processes for Engineers, Cambridge unipress, 2015
2	Athanasios Papoulis and S. Unnikrishna Pillai - Probability, Random Variables and Stochastic Processes, 4th Ed., PHI, 2002.
3	B.P. Lathi - Signals, Systems & Communications, B.S. Publications, 2003.

4	S.P Eugene Xavier -Statistical Theory of Communication, New Age Publications, 2003.
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Web Details

1	https://en.wikibooks.org/wiki/Calculus/Complex_analysis (Functions of a Complex Variable)
2	https://youtu.be/60ReaZWsvCA (complex power series)
3	https://www.probabilityandrandomvariables.com (Probability and Random variables)
4	https://youtu.be/SURf12yfrBY (Moment generating functions)
5	https://uotechnology.edu.stochasticprocess (Stochastic Process)

		Name	Signature with
i.	Faculty I	Mrs P.Durga Bhavani	P. Durga Bhavani
ii.	Faculty II	Mrs R.V.Lakshmi	R.V. Lakshmi
iii.	Course Coordinator	Mrs P.Durga Bhavani	P. Durga Bhavani
iv.	Module Coordinator	Mrs R.V.Lakshmi	R.V. Lakshmi
v.	HOD of S & H	Dr. V. SWAMINADHAM.	V. Swaminadham


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