DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	**M-Tech Communication Systems** – M.TECH - I st year		
Course Title	**Wavelet Signal Processing**		
Course Code	**EC619**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)			
Session	**January 2020**	**Section (if, applicable)**	
Name of Faculty	**Dr. Varun P. Gopi**	**Department**	**ECE**
Email	**varun@nitt.edu**	**Telephone No.**	**+919995114547**
Name of Course Coordinator(s) (if, applicable)			
E-mail		**Telephone No.**	
Course Type	☐ **Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

Limitations of standard Fourier analysis. Windowed Fourier transforms. Continuous wavelet transforms. Time-frequency resolution.

Wavelet bases. Balian-Low theorem. Multiresolution analysis. (MRA). Construction of wavelets from MRA. Fast wavelet algorithm.

Compactly supported wavelets. Cascade algorithm. Franklin and spline wavelets. Wavelet packets. Hilbert space frames. Frame representation. Representation of signals by frames. Iterative reconstruction. Frame algorithm.

Wavelet methods for signal processing. Noise suppression. Representation of noise-corrupted signals using frames. Algorithm for reconstruction from corrupted frame representation.

Wavelet methods for image processing. Burt-Adelson and Mallat's pyramidal decomposition schemes. 2D-dyadic wavelet transforms.

COURSE OBJECTIVES

1. To expose the students to the basics of wavelet theory.
2. To illustrate the use of wavelet processing for data compression and noise suppression

.

COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
1. Understand about windowed Fourier transform and difference between windowed Fourier transform and wavelet transform.	PO 1,2,3
2. Understand wavelet basis and characterize continuous and discrete wavelet transforms.	PO 1,2,3
3. Understand multi resolution analysis and identify various wavelets and evaluate their time-frequency resolution properties	PO 1,2,3
4. Implement discrete wavelet transforms with multirate digital filters.	PO 1,2,3
5. Understand about wavelet packet.	PO 1,2,3
6. Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.	PO 1,2,3

COURSE PLAN – PART II

COURSE OVERVIEW

This is an introductory course on wavelet analysis, with an emphasis on the fundamental mathematical principles and basic algorithms. This course focuses on the windowed Fourier transform, the continuous wavelet transform, discrete wavelets, orthogonal and biorthogonal wavelets of compact support, wavelet regularity, and wavelet packets. It is designed as a broad introduction to wavelets for engineers and mathematicians.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	**I WEEK 6th to 10th January (3 contact hours)**	Limitations of standard Fourier analysis.	C&T, PPT, group discussion, Quizzes,
2	**2 WEEK 13th to 17th January (3 contact hours)**	Windowed Fourier transforms.	
3	**3WEEK 20th to 24th January (3 contact hours)**	Continuous wavelet transforms. Time-frequency resolution.	

4	**4 WEEK** **27th to 31th January** **(3 contact hours)**	Wavelet bases. Balian-Low theorem.	assignments
5	**5 WEEK** **3th to 7th February** **(3 contact hours)**	Multiresolution analysis. (MRA). Construction of wavelets from MRA.	
6	**6 WEEK** **10th to 14th February** **(3 contact hours)**	Fast wavelet algorithm.	C&T, PPT, group discussion, Quizzes, assignments
7	**7 WEEK** **17th to 21th February** **(3 contact hours)**	Compactly supported wavelets. Cascade algorithm.	
8	**8 WEEK** **24th to 28th February** **(3 contact hours)**	Franklin and spline wavelets. Wavelet packets.	
9	**9 WEEK** **2rd to 6thMarch** **(3 contact hours)**	Hilbert space frames.	
10	**10 WEEK** **11th to 12thMarch** **(3 contact hours)**	Frame representation. Representation of signals by frames. Iterative reconstruction. Frame algorithm	
11	**11 WEEK** **16th to 20thMarch** **(3 contact hours)**	Wavelet methods for signal processing.	
12	**12 WEEK** **23th to 27thMarch** **(3 contact hours)**	Noise suppression. Representation of noise-corrupted signals using frames.	
13	**13 WEEK** **30st to 31 st March** **1st to 3th April** **(3 contact hours)**	Algorithm for reconstruction from corrupted frame representation.	
14	**14 WEEK** **7th to 9th April** **(3 contact hours)**	Wavelet methods for image processing.	
15	**15 WEEK** **13nd to 17th April** **(3 contact hours)**	Burt-Adelson and Mallat's pyramidal decomposition schemes.	
16	**16 WEEK** **20nd to 24th April** **(3 contact hours)**	2D-dyadic wavelet transforms.	
COURSE ASSESSMENT METHODS (shall range from 4 to 6)			

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assignment 1	4th Week		10
2	Close book (Descriptive Type Examination)	7th Week	60 Minutes	15
3	Assignment 2	11th Week		10
4	Close book (Descriptive Type Examination)	12th Week	60 Minutes	20
CPA	Compensation Assessment*	13th WEEK	60 minutes	Please refer course policy for more details
5	Quiz/Project	14th Week	30 Minutes	10
6	Final Assessment *	16th Week	180 Minutes	35

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. The students through class representative may give their feedback at any time which will be duly addressed.
2. Feedback from the students through MIS and class committee meetings

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

All the students are advised to come to the class regularly. All the correspondence (schedule of classes/ schedule of assignment/ course material/ any other information regarding this course) will be intimated in the class as well as in group mail.

COMPENSATION ASSESSMENT POLICY

If any student who fails to attend assessment 2 or assessment 4 due to any genuine reasons, student is permitted to attend compensation assessment for the weightage of 20 % (Including assessment 2 & assessment 4 Portions)

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

  The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

The faculty is available for consultation at times as per the intimation given by the faculty

FOR APPROVAL

Course Faculty Dr. Vaishnavi Gupta **CC-Chairperson** (Dr. B. Rebekka) **HOD**

Guidelines:

a) **The number of assessments for a course shall range from 4 to 6.**

b) **Every course shall have a final assessment on the entire syllabus with at least 30% weightage.**

c) **One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered. Details of compensation assessment to be specified by faculty.**

d) **The passing minimum shall be as per the regulations.**

e) **Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.**

f) **Absolute grading policy shall be incorporated if the number of students per course is less than 10.**

g) **Necessary care shall be taken to ensure that the course plan is reasonable and is objective.**