Roll No. ....

Y – 3182 (A)

M.A/M.Sc. (Mathematics) (Fourth Semester) (SPECIAL)

EXAMINATION, August 2021

(SECOND CHANCE)

Paper – 403

WAVELETS

Time : Three Hours

Maximum Marks : 85 (For Regular Students) *Minimum Pass Marks : 29*

Maximum Marks : 100 (For Private Students) *Minimum Pass Marks : 34*

Note—Attempt *all* questions.

1. Obtain two dimensional Fast Haar Wavelet transform for the data— 17/20

$$\begin{pmatrix} 9 & 7 & 6 & 2 \\ 5 & 3 & 4 & 4 \\ 8 & 2 & 4 & 0 \\ 6 & 0 & 2 & 2 \end{pmatrix}$$

2. Define Daubechies basic building block ϕ and its associated wavelet ψ. Obtain the value of— 17/20

$$\phi\left(\frac{5}{2}\right), \phi\left(\frac{3}{2}\right), \psi\left(\frac{1}{2}\right), \psi\left(\frac{3}{2}\right).$$

3. Define Forward Fast Fourier Transform and prove that for each, $k \in \left\{0, 1, 2, \ldots\ldots, \frac{N}{2}-1\right\}$ $\hat{f}_k = \frac{1}{2}\left[\text{even}\,\hat{f}_k + \left\{e^{-2\pi i/N}\right\}^k \left\{\text{odd}\,\hat{f}_k\right\}\right]$ and

$$f\,\frac{k+N}{2} = \frac{1}{2}\left[\text{even}\,\hat{f}_k - \left\{e^{-2\pi i/N}\right\}^k \left\{\text{odd}\,\hat{f}_k\right\}\right].$$ 17/20

4. Prove that for every $f \in C^0_1, 2T^{(R,C)}$ and for every $t \in R$ where the derivative $f'(t)$ exists, the partial sums—

   $S_N(f)(t)$ converges to $f(t)$ *i.e.* $\lim_{N\to\infty} S_N(f)(t) = f(t)$ 17/20

5. Prove that for each integrable function $f : R \to C$ such that $\lim_{|t|\to\infty} f(t) = 0$, the set $\{f_c : C > 0\}$ defined by $f_c(t) = \frac{1}{C} f\left(\frac{t}{C}\right)$ constitutes an approximate identity. 17/20