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| **Scheme of Valuation/Answer Key**(Scheme of evaluation (marks in brackets) and answers of problems/key) |
| **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**V SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018 |
| **Course Code: AE307** |
| **Course Name: SIGNALS AND SYSTEMS** |
| Max. Marks: 100 |  | Duration: 3 Hours |
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| **PART A**  |
|  |  | ***Answer any two full questions, each carries 15 marks.*** | Marks |
| 1 | a) |  (i)$^{T1}/\_{T2}$= 6/8=$\frac{3}{4}$; A rational number is periodic. $fundamental period T=24seconds$(ii) Steps Even=$1+t^{3}\sin(\left(t\right))cos⁡(t)$Odd=$tcos\left(t\right)+t^{2}sin⁡(t)$ | (2)(1)(1)(1) |
|  | b) | (i)Equation &Calculation.Energy signal ; E=1/6; P=0(ii)Equation& CalculationPower signal; E=infinity; P=1/2 | (1.5)(1)(1.5)(1) |
|  | c) | (i)(ii) | (2.5)(2.5) |
| 2 | a) | (i) Causal Stable(ii) not causal  Not stable (iii) not causal  Stable(iv) Not causal h(n) ≠ 0 ; for n<0Stable | (2)(2)(2)(2) |
|  | b) | i) Non linear, Justification (ii) Non Linear, Justification(iii) Linear, Justification | ( 1)( 1)( 1)( 1) |
|  | c) | (i) Time variant(ii) Time variant | (1.5)(1.5) |
| 3 | a) | EquationDiagrams and stepsAnswer$$y\left(t\right)=0 for t<3$$$$y\left(t\right)=\frac{1-e^{-3(t-3)}}{3}; 3\leq t<5$$$$y\left(t\right)=\frac{e^{-3(t-5)}-e^{-3(t-3)}}{3} ; 3\leq τ<5$$ | (1)(3.5)(3) |
|  | b) | Steps and calculations$$y\_{f}=-2u\left(n\right)+\frac{1}{3}\left(0.5\right)^{n}u\left(n\right)+\frac{8}{3}\left(2\right)^{n}u(n)$$ | (6)(1.5) |
| **PART B**  |
| ***Answer any two full questions, each carries 15 marks.*** |
| 4 | a) | EquationsDiagramExplanation | (2)(1)(4.5) |
|  | b) | Explanation | (7.5) |
| 5 | a) | Explanation with equation.Properties | (3.5)(4) |
|  | b) | Sampling theoremAliasingReconstruction filter | (2.5)(2.5)(2.5) |
| 6 | a) | N = 16, Ωo = 2π/ 16= π/8 K=-7 to 8Equation and comparison $$X\left(k\right)=\left\{\begin{array}{c}\frac{1}{2}e^{-jՓ; k=-1}\\\frac{1}{2}e^{jՓ; k=1}\\0 ; otherwise on-7\leq k\leq 8\end{array}\right.$$ | (1)(1)(3) |
|  | b) | Steps$$x\left(n\right)=\frac{sinπ(n-1)}{π(n-1)}$$ | (4)(1) |
|  | c) | Equation Steps$$X\left(jω\right)=\frac{8}{16+ω^{2}}$$Magnitude and Phase Spectra | (1)(2)(1)(1) |
| **PART C**  |
| ***Answer any two full questions,each carries 20 marks.*** |
| 7 | a) | (i) Equation StepsAnswer, $X\left(s\right)=\frac{2s+5}{s^{2}+5s+6}, Re\left(s\right)>-2$Zeros at s = -5/2 and poles at s = -2 and s = -3 ,Plot S plane (ii) Equation and steps$$X\left(s\right)=\frac{3}{s^{2}+9 } , Re\left(s\right)>0$$Poles at $s=$ and Plot S plane | (1)(1)(1)(2)(2.5)(1)(1.5) |
|  | b) | $$w\left[n\right]=\left(\frac{-1}{2}\right)^{n}u\left[n\right]↔W(z)=\frac{z}{z+\frac{1}{2}} ; ROC \left|z\right|>1/2$$Appling z domain Differentiation property$$ n\left(\frac{-1}{2}\right)^{n}u\left[n\right]= -z\frac{d}{dz}(\frac{z}{z+\frac{1}{2}})ROC\left|z\right|>1/2$$$$= \frac{\frac{-1}{2}z}{\left(z+\frac{1}{2}\right)^{2}} with ROC\left|z\right|>1/2$$Next$$= \left(\frac{1}{4}\right)^{n}u\left[n\right]↔\frac{z}{z-\frac{1}{4}} with ROC\left|z\right|>1/4$$ Applying Time reversal property$$y\left[n\right]↔Y\left(z\right)=\frac{\frac{1}{z}}{\frac{1}{z}-\frac{1}{4}} with ROC \frac{1}{\left|z\right|}>\frac{1}{4}$$=$\frac{-4}{z-4 } with ROC\left|z\right|<4$Applying Convolution Property$$X\left(z\right)=W\left(z\right)Y\left(z\right)with ROC R\_{w}∩R\_{y}$$$$=\frac{2z}{(z-4)(z+\frac{1}{2})^{2}} with ROC 1/2<\left|z\right|<4$$ | (2)(2)(1)(2)(1)(1)(1) |
| 8 | a) | Steps $$H\left(s\right)=\frac{s-2}{s^{2}+2s+1}$$ | (4)(1) |
|  | b) | Steps$$h\left(t\right)=2e^{-3t}u\left(t\right)+e^{2t}u\left(t\right)$$Not stable | (3)(1)(1) |
|  | c) | Properties (each point carrying 2 marks) | (10) |
| 9 | a) | (i) Linearity(ii)Time shifting(iii)Convolution | (2)(3)(5) |
|  | b) | Steps$$X\left(z\right)=\frac{(sinω\_{0})z^{-1}}{1-2\left(cosω\_{0}\right)z^{-1}+z^{-2 }} ; ROC:\left|z\right|>1$$ | (4)(1) |
|  | c) | Steps(Partial Fraction)A=1; B=2; C= -2$$x\left(n\right)=(1/2)^{n}u\left[n\right]-2(2)^{n}u\left[-n-1\right]-2u[n]$$ | (4)(1) |
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