

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
 SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

2017/2018 HARMATTAN SEMESTER ENG 307 TEST; COURSE TITLE: ENGINEERING MATHEMATICS I

INSTRUCTIONS: ANSWER ALL QUESTIONS. TIME ALLOWED: ONE (1) HOUR

1) Compute $\frac{\partial^2 f}{\partial r^2}$ for $f(x, y)$ if $x = r \cos \theta$ and $y = r \sin \theta$ (5 marks)

$$f(x) = \frac{1}{s^2} e^t = \frac{1}{(s-1)^2}$$

2) Find the Laplace transform of the function: $f(x) = t e^t + \sin(3t) e^{2t} + \cos(5t) e^{2t}$. (5 marks)

$$\frac{8}{s^2+9} = \frac{3}{(s-1)^2+9}$$

3) Solve the initial value problem: $y'' + y' - 2y = 0$, $y(0) = 4$ and $y'(0) = 1$. (5 marks)

$$(s^2 - s)(s^3 - s^2 + 9s - 9) = 1 + j$$

$$s^5 - s^4 + 9s^3 - 9s^2 - s^4 + s^3 - 9s + 9s$$

$$s^5 - 2s^4 + 10s^3 - 18s^2 + 9s$$

$$\frac{(s^2+9)(s-1)}{s^3 - s^2 + 9s - 9}$$

rewrite

$$\frac{[s^3 - s^2 + 9s - 9][s^3 - 2s^2 + 25s - 50]}{s^6 - 2s^5 + 25s^4 - 50s^3}$$

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI

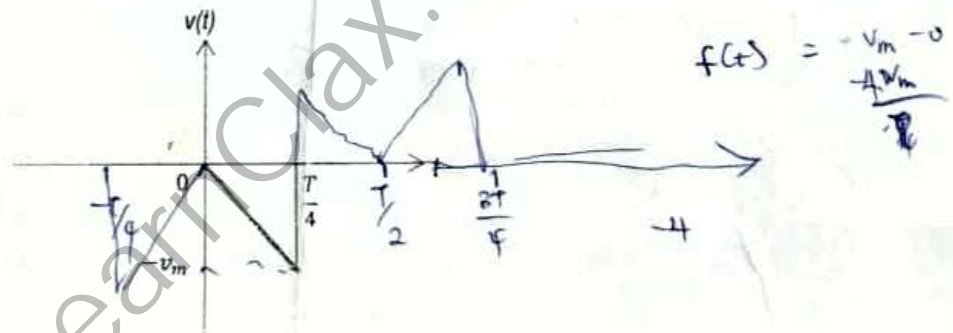
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

2017/2018 HARMATTAN SEMESTER ENG 307 TEST; COURSE TITLE: ENGINEERING MATHEMATICS I

INSTRUCTIONS: ANSWER ALL QUESTIONS; TIME ALLOWED: ONE (1) HOUR

1) Using your knowledge of beta and gamma function, evaluate $\int_0^{\frac{1}{2}} x^4 (1-2x)^3 dx$. (5 marks)

2) The periodic function $v(t)$ shown below is even and has quarter-wave symmetry. (a) Sketch one full cycle of the function over the interval $-\frac{T}{4} \leq t \leq \frac{3T}{4}$. (1 mark) (b) Repeat part (a) for $f(t)$ over the same interval given that $f(t) = \frac{dv(t)}{dt}$. (2 marks) (c) Comment on the Fourier coefficients of $f(t)$. (2 marks)



3) The current, I milliamperes, in a circuit is measured for various values of applied voltage V volts. If the law connecting I and V is $I = aV^n$, where a and n are constants, apply the method of least squares to obtain the values of a and n that give the best fit to the given set of values (5 marks).

V	8	12	15	20	28	36
I	41.1	55.6	65.8	31.6	105	127