LAGOS CITY POLYTECHNIC, IKEJA
SCHOOL OF ENGINEERING AND APPLIED SCIENCE
DEPARTMENT OF COMPUTER ENGINEERING
2015/2016 SEMESTER EXAMINATION

COURSE TITLE: ADVANCED CALCULUS **NO OF QUESTION: 6**
COURSE CODE: MTH 312 **TIME: ALLOWED: 2½HRS**
FOR WHOM: HND YR 1 CE & EE PT **INSTRUCTIONS: Answer any 4 questions**

1. (a) Define a Laplace transformation of a function $f(t)$
   (b) Write out the Laplace transforms of any five elementary functions that you know.
   (c) Obtain the Laplace transforms of the following functions
   (i) $L\{2 \quad 3t + {}^1/_3 t^4\}$ (ii) $L\{5e^{2t} \quad 3e^{-t}\}$
   (iii) $L\{6\sin \quad 3t4\cos 5t\}$ (iv) $L\{2\cosh 2t \quad \sinh 3t\}$
   (d) State the first shifting theorem and hence
   (e) Evaluate the Laplace transform $L\{e^{2t} \sin 3t)$
2. (a) State the second theorem of Laplace tranform treated with you.
   (b) Use the above result to evaluate the Laplace transform $L\{t\cos 3t\}$
   (c) By evaluating the Laplace transform $L\{{}^{\sin t}/_t\}$, prove that the improper integral
   $$\int_0^\infty \frac{\sin t}{t}\, dt = \frac{\pi}{2}$$
   (d) Obtain the Laplace transform of the first and second derivatives.
3. (a) Obtain the inverse Laplace transform of the following:
   (i) $L^{-1}\left\{\frac{1}{s+3} + \frac{3}{s^2+9} \quad \frac{3s}{s^2+5}\right\}$ (ii) $L^{-1}\left\{\frac{4s}{s^2\ 3} \quad \frac{12}{s^4} + \frac{1}{2s\ 5}\right\}$
   (b) Solve by Laplace transform the initial value problem
   $2\frac{d^2y}{dt^2} + 5\frac{dy}{dt} \quad 3y = 0$, given that $y(0) = 4$ and $y1(0) = 9$
   (c) The current flowing in an electrical circuit is given by the differential equation
   $L\frac{dI}{dt} + RI = E$, where E, L and R are constants.
   Use Laplace transforms to solve the equation for current I given that when $t = 0$, $I = 0$.
4. (a) Define a Fourier series and state clearly the coefficients of the series
   (b) What do you understand by periodic function
   (c) State the Dirichlets conditions
   (d) Obtain a Fourier series for the periodic function $f(x)$ define as:
   $f(x) = -k$ if $-\pi < x < 0$
   $\quad\;\; = k$ if $0 < x < \pi$
   The function is periodic outside of this range with period 2π
5. (a) What do you understand by type I and type II region?
   (b) State the Fubinis theorem