

(6 pages)

Reg. No. : .....

Code No. : 8536

Sub. Code : HPHE 21

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2013.

Second Semester

Physics

NONLINEAR DYNAMICS AND CHAOS

(For those who joined in July 2012 onwards)

Time : Three hours

Maximum : 75 marks

PART A — ( $10 \times 1 = 10$  marks)

Answer ALL questions.

Choose the correct answer.

1. Simple pendulum is an example of \_\_\_\_\_ oscillator
- (a) Electronic
  - (b) Harmonic
  - (c) Resonating
  - (d) Vibrating

2. An example for non-linear oscillator is
- (a) Van der Pol oscillator
  - (b) Harmonic oscillator
  - (c) Spring oscillator
  - (d) None of the above
3. A series of period-halving bifurcations leads the system from chaos to
- (a) Order
  - (b) Disorder
  - (c) Chaos
  - (d) None
4. An example of duffing oscillator is
- (a) Hamiltonian oscillators
  - (b) Damping oscillators
  - (c) Cubic-quintic oscillators
  - (d) None of the above
5. The frequency of a colpitts oscillator is given by
- (a)  $f = 1/(2\pi\sqrt{C})$
  - (b)  $f = LC/(2\sqrt{R})$
  - (c)  $f = 1/(2\sqrt{LC})$
  - (d) None of the above

Page 2

Code No. : 8536



6. The sierpinski triangle is also called  
(a) Sierpinski gasket  
(b) Magic Sieve  
(c) Right angled triangle  
(d) Simple triangle
7. The soliton phenomenon was first described by  
(a) Lise Meitner  
(b) Hermann Helmholtz  
(c) John Scott Russell  
(d) Albert Einstein
8. Korteweg-de Vries equation is an example of  
(a) KdV equation  
(b) Lorentz transformation equation  
(c) Russell's equation  
(d) none of the above
9. Waves can propagate without deformation in  
(a) Nodes (b) Medium  
(c) Intensity (d) Energy

Page 3 Code No. : 8536

10. Korteweg-de Vries equation is a mathematical model of waves on  
(a) Conical sections  
(b) Cylindrical surfaces  
(c) shallow water surfaces  
(d) none of the above

PART B — ( $5 \times 5 = 25$  marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Distinguish between linear and non linear systems.

Or

- (b) What is predictability?

12. (a) Write a short note on logistic maps.

Or

- (b) What do you mean by periodic doubling?

13. (a) Distinguish linear and nonlinear critical elements.

Or

- (b) Explain R-L diode circuit.

Page 4 Code No. : 8536  
[P.T.O.]





14. (a) Explain fractal dimension.

Or

- (b) Write a short note on Koch curve.

15. (a) What are solitons?

Or

- (b) Explain Korteweg de Vries equation.

PART C — ( $5 \times 8 = 40$  marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Explain damping. Distinguish damped and driven oscillators.

Or

- (b) Write a short note on dissipative forces. Then distinguish between dissipative and non dissipative forces.

17. (a) Write a short note on bifurcation and duffing oscillator.

Or

- (b) Explain equilibrium points. Hence explain general criteria for stability.

18. (a) Explain analogue circuit simulations. Find the condition for resonance in analogue non linear circuits.

Or

- (b) What do you mean by chaos? Explain chaotic dynamics of MLC circuits.

19. (a) Explain Koch curve and Sierpinski Triangle.

Or

- (b) Explain Mandelbrot set, construction similarity and differences.

20. (a) Write a short note on Scott Russell phenomenon and explain KdV equation.

Or

- (b) Explain Korteweg de Vries equation. What are the applications of solitons?

