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Reg. No. :

**Code No. : 30371 E Sub. Code : JMMA 6 C/
SEMA 6 C**

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2020.

Sixth Semester

Mathematics – Main

Major Elective – III – MATHEMATICAL MODELLING

(For those who joined in July 2016 onwards)

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer :

1. The radio-active decay for white lead is

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- (a) 4 Years
 - (b) 8 Years
 - (c) 11 Years
 - (d) 22 Years

2. The time period for simple harmonic motion is

(a) $2\pi\sqrt{\frac{a}{g}}$

(b) $2\pi\sqrt{\frac{g}{a}}$

(c) $\frac{1}{2\pi}\sqrt{\frac{a}{g}}$

(d) $\frac{1}{2\pi}\sqrt{\frac{g}{a}}$

3. In SIS-Model, $\frac{ds}{dt} =$ _____

(a) $\beta SI + \gamma I$

(b) $-\beta SI + \gamma I$

(c) $\beta SI - \gamma I$

(d) $-\beta SI - \gamma I$

4. In Domar Macro Model, $I(t) =$ _____

(a) $Y(t)$

(b) $-Y(t)$

(c) $S(t)$

(d) $-S(t)$

5. The acceleration of the planet towards the sun is

(a) $\frac{GS}{r^2}$

(b) $\frac{GP}{r^2}$

(c) $\frac{\mu}{r^2}$

(d) $\frac{\mu}{r}$

6. If $e=1$, then the path is _____
 (a) Parabola (b) Hyperbola
 (c) Ellipse (d) None of these
7. In the inverse square law, central force $F=$ _____
 (a) $\frac{\mu}{r}$ (b) $\frac{\mu}{r^2}$
 (c) $\frac{r}{\mu}$ (d) $\frac{r^2}{\mu}$
8. In Samuelson's Interaction Models, $Y(t)=$ _____
 (a) $C(t)$ (b) $I(t)$
 (c) $C(t)+I(t)$ (d) $C(t)-I(t)$
9. A graph in which every pair of its vertices is joined by an edge is called _____
 (a) Digraph (b) Regular
 (c) Complete (d) Signed graph
10. The Euler's formula for a polygonal graph is _____
 (a) $V+E+F=2$ (b) $V+E-F=2$
 (c) $V-E+F=2$ (d) $V-E-F=2$

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Find the orthogonal trajectories of

$$\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1, \lambda - \text{parameter.}$$

Or

- (b) Explain population growth Models.

12. (a) Explain the stability of Market Equilibrium.

Or

- (b) Discuss Domar Macro Model.

13. (a) State and prove Kepler's third law of planetary motion.

Or

- (b) Discuss the circular motion of satellites.

14. (a) Derive the Harrod Model.

Or

- (b) Discuss the Samuelson's Interaction Models.

15. (a) Write a note on balance of signed graphs.

Or

- (b) Define planar graphs and draw two non planar graphs.

PART C — ($5 \times 8 = 40$ marks)

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

Each answer should not exceed 600 words.

16. (a) Discuss the motion of a rocket when gravity is taken into account.

Or

- (b) Derive the equation of Simple Harmonic Motion.

17. (a) Derive Richardson's Model for Arms Race.

Or

- (b) Prove that $S(t) = \frac{n(n+1)}{n + e^{(n+1)\beta t}}$ and $I(t) = \frac{(n+1)e^{(n+1)\beta t}}{n + e^{(n+1)\beta t}}$ for simple Epidemic Model.

18. (a) Prove that the radial and trasverse components of acceleration are $r'' - r\theta'^2$ and $\frac{1}{r} \frac{d}{dt}(r^2\theta')$.

Or

- (b) Prove that $\frac{d^2 u}{d\theta^2} + u = \frac{F}{h^2 u^2}$.

19. (a) State and prove Hardy-Weinberg Law.

Or

(b) Define the Cobweb Model.

20. (a) Explain the application of Directed graph to detection of cliques.

Or

(b) Discuss the weighted digraphs and Markov chains.
