Case 2:

$$s(t) = \frac{2}{5} - \frac{41}{2500}t + \frac{991}{2500000}t^2 - \frac{265369}{3750000000}t^3 + \frac{50195873}{7500000000000}t^4 + O(t^5).$$
$$e(t) = \frac{1}{5} + \frac{18}{625}t + \frac{1013}{2500000}t^2 + \frac{273323}{3750000000}t^3 - \frac{41249251}{7500000000000}t^4 + O(t^5).$$
$$i(t) = \frac{1}{10} - \frac{9}{2500}t + \frac{1161}{625000}t^2 - \frac{243703}{1875000000}t^3 + \frac{34601071}{3750000000000}t^4 + O(t^5).$$
$$r(t) = \frac{3}{10} + \frac{17}{500}t - \frac{61}{31250}t^2 + \frac{14227}{9370000}t^3 - \frac{3128621}{375000000000}t^4 + O(t^5).$$

Case 3:

$$s(t) = \frac{2}{5} + \frac{9}{2500}t - \frac{3159}{2500000}t^2 - \frac{37173}{1250000000}t^3 + \frac{7995141}{2500000000000}t^4 + O(t^5).$$
$$e(t) = \frac{1}{5} + \frac{18}{625}t + \frac{2763}{2500000}t^2 + \frac{106191}{1250000000}t^3 - \frac{6079167}{2500000000000}t^4 + O(t^5).$$
$$i(t) = \frac{1}{10} - \frac{9}{2500}t + \frac{1161}{625000}t^2 - \frac{66651}{625000000}t^3 + \frac{10219107}{1250000000000}t^4 + O(t^5).$$
$$r(t) = \frac{3}{10} + \frac{7}{500}t - \frac{119}{125000}t^2 + \frac{5551}{46875000}t^3 - \frac{2509871}{375000000000}t^4 + O(t^5).$$

Case 4:

$$s(t) = \frac{2}{5} + \frac{59}{2500}t - \frac{7309}{2500000}t^2 + \frac{42331}{3750000000}t^3 - \frac{12725027}{7500000000000}t^4 + O(t^5).$$
$$e(t) = \frac{1}{5} + \frac{18}{625}t + \frac{4513}{2500000}t^2 + \frac{363823}{3750000000}t^3 + \frac{15274249}{7500000000000}t^4 + O(t^5).$$
$$i(t) = \frac{1}{10} - \frac{9}{2500}t + \frac{1161}{625000}t^2 - \frac{156203}{1875000000}t^3 + \frac{26713571}{3750000000000}t^4 + O(t^5).$$
$$r(t) = \frac{3}{10} - \frac{3}{500}t + \frac{3}{62500}t^2 + \frac{2659}{31250000}t^3 - \frac{1891121}{375000000000}t^4 + O(t^5).$$

REFERENCES

[1] Makinde, O.D., 2007, "Adomian decomposition approach to a SIR epidemic model with constant vaccination strategy," Applied Mathematics and Computation, 184, pp.842-848.

[2] Moghadas, S.M., and Gumel, A.B., 2003, "A mathematical study of a model for childhood diseases with non-permanent immunity," Journal of computational and applied Mathematics, 153, pp. 347-363.

[3] Makinde, O.D., 2009, "On non-pertubative approach to transmission dynamics of infectious diseases with waning immunity," Intern. Journ. Of nonlinear sciences and numerical simulation, 10, pp. 451-458.

[4] Jiao, Y.C., Yamamoto, Y., and Dang, C.; Hao, Y., 2002, "An after treatment technique for improving the accuracy of Adomian's decomposition method," Computers and Mathematics with Applications, 43, pp. 783–798.

[5] Christodoulou, N.S., 2009,"An algorithm using Runge-Kutta methods of order 4 and 5 for systems of ODEs," International journal of numerical methods and applications, 2, pp. 47-57.

[6] Wazwaz, A.M., 1998, A reliable modification of Adomian's decomposition method, Appl. Math. and Comput., 92, pp. 1–7.

[7] Wazwaz, A.M., 2000,"A new technique for calculating Adomian polynomials for nonlinear operators," Appl. Math. Comput.,111, pp. 33–51.

[8] Cherruault, Y., 1989,"Convergence of Adomian's method," Kybernotes,18, pp. 31–38.

[9] Cherruault, Y., andAdomian, G., 1993,"Decomposition methods: a new proof of convergence," Math. Comput. Modelling, 18, pp.103–106.

[10] Martcheva, M., 2015,"An Introduction to Mathematical Epidemiology," Springer: New York, USA, 61.

[11] World Health Organization,2015,"Weekly Epidemiological record,"No. 46(90), pp. 617- 632.

[12] Atkinson, K. E., 2008,"An introduction to numerical analysis," 2nd ed., John Wiley & Sons: New York, USA.

[13] Boyce, W.E., and Diprima, R.C., 2012,"Elementary Differential equations and Boundary Value problems," 10th ed., John Wiley & Sons: New York, USA.

[14] May, R.M., and Anderson, R.M., 1979, "Population biology of infectious diseases: Part II," Nature, 280, pp. 455-461.

[15] "Principles of infectious disease epidemiology,"available online: http://health.mo.gov/training/epi/Mod2StudentOutline.pdf,(accessed on 4th January 2016),

[16] Li, M.Y., andMuldowney, J.S., 2000,"Dynamics of Differential Equations on Invariant Manifolds," Journal of Differential Equations,168, pp. 295-320.

[17] HethCote, H.W., 2000,“The Mathematics of Infectious diseases,” Society for Indust. And Applied Math., 42, pp. 599-653.

[18] Brauer, F., and Castillo-Chavez, C., 2001,“Mathematical models in population biology and epidemiology,” Springer-Verlag,40, pp xxiv+-416.

[19] Arrowsmith, D.K., and Place, C.M., 1983,“Ordinary differential equations, series 2,” Chapman and Hall, 26, pp. 287-288.

[20] Anderson, R. M., and May, R.M., 1192, “Anderson, B. Infectious diseases of humans: dynamics and control,” Oxford: Oxford university press, UK, 28.

[21] Chitnis, N., Hyman, J.M., and Cushing, J.M., 2008, “Determining important parameters in the spread of Malaria through the Sensitivity Analysis of a mathematical model,” Bulletin of Mathematical Biology, 70, pp.1272-1296.

[22] Naji, R.K., and Hussien, R.M., 2016, “The dynamics of epidemic model with two types of infectious diseases and vertical transmission,” Journal of Applied Mathematics.

[23] Okosun K.O., and Makinde, O.D., 2012, “On a drug-resistant malaria model with susceptible individuals without access to basic amenities,”Journal of biological physics,38, pp.507-530.