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ANALYSIS OF A GENERALIZED Mx/Ek/1/1 QUEUEING MODEL WITH BULK ARRIVALS AND ERLANGIAN SERVICE TIME DISTRIBUTION

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Abstract

In a rapid innovative growth of science and technologies, queueing problems have attracted the interest of keen researchers in view of its wide applications to computer networks, data ransmissions, nervous reaction, psychological stress, neurophysiological problems, filtration process and road traffic congestion etc. The origin of queueing theory goes back to a Danish Mathematician A. K. Erlang (1878-1929) on congestion of telephonic calls who was a Telephone Engineer at Copenhagen. An excellent account of his tremendous work has been given by Brochmeyer et al [2] in 1948. Before 1950, most of the work on the queueing theory was endeavored in connection with telephonic problem alone but after 1950, it was observed by

researchers and mathematicians that the work done in connection with telephonic problem had a terrific scope with emergence of 'Operational Research' as a well recognized discipline. Since then, the queueing theory has been studied extensively in various fields of machine maintenance, defense operations, inventory management and other emerging areas of science and technologies. Among various queueing models, bulk arrival queueing models with batch service have gained wide applications in modern telecommunication systems, computer networks etc. Looking from this point of view, tremendous innovation and investigation have been done efficiently by some noteworthy researchers [1, 2, 3, 4, 6, 8, 9, 10, 11, 12 & 13] in a well organized and decent manner. In recent years, some mixed queueing models have been analyzed by a number of researchers [8, 9, 10, 11 & 13] taking into account of one or both bulk arrivals and batch services with some other invariant parameters like; general service time distribution, impatient behavior of input customers and service with vacation model or controllable arrival rates etc. Igaki et al [7] have considered a generalized M/G/1 gueueing model incorporating the concept of service degradation enforcement to enhance the M/M/1 queueing model and succeeded to investigate useful results such as idle and busy period

equations, number of present customers in the system at time t etc. Recently Thiagarajan and Srinivasan [13] discussed an Mx/Ek/1/1 interdependent queueing model taking into account of controllable arrival rates of input customers and they obtained the steady state equations and performance measures of the model. Yet in spite of so much earlier researches in the field of queueing theory, not much work has been reported so far dealing with queueing models incorporating the concept of both bulk arrivals of input customers and Erlangian service time distribution. In the present paper, we consider a generalized Mx/Ek/1/1 queueing model with bulk arrivals of variable size x _ 1 distributed as Poisson distribution with parameter _ and Erlan-gian service time distribution and our keen interest is to endeavor both the idle and busy period equations, joint probability mass function in terms of joint probability distribution function etc. by using Laplace transform technique. Moreover, some particular cases of the Mx/Ek/1/1 queueing model have also been discussed efficiently in the last section. It is of our interest to remark here that our investigated powerful results are very much significant and these results may be treated as tool source for the performance analysis of the queueing model taken into our present consideration.