

SYSTEM THEORETIC APPROACHES TO EDUCATIONAL SYSTEM PLANNING AND MANAGEMENT

BY
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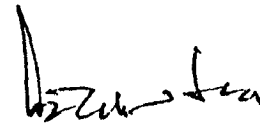
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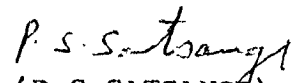
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This Thesis is dedicated to
the memory of my grand parents
Smt. and Sri Laxminarayanji Bhavsar.

CERTIFICATE

This is to certify that the thesis entitled,
"SYSTEM THEORETIC APPROACHES TO EDUCATIONAL SYSTEM
PLANNING AND MANAGEMENT" being submitted by BAL MUKUND
GUPTA for the award of a 'DOCTOR OF PHILOSOPHY' degree
to him by the INDIAN INSTITUTE OF TECHNOLOGY, Delhi
is a record of bonafide research work he has carried out
under our guidance and supervision. The results obtained
in this thesis have not been submitted to any other
university or institute for the award of a degree or
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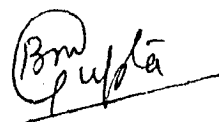
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ABSTRACT

Modern system theory has met with tremendous success especially in areas where the system is well defined; however, it has failed to cope adequately with the practicalities of many other systems, more so in case of societal systems. This is mainly due to the lack of detailed structural knowledge of the process, its parameters and variables. Educational systems form a part of the societal systems and are predominantly human-based where human subjectivity plays a major role. This is why they are imprecise, vague and inexact. The inexactness is not only due to uncertainty but more due to illdefined, imprecisely defined or vaguely defined values of the parameters and variables. The tools and techniques of statistics and probability theory alone will not give satisfactory results when applied to such systems. At present, since there are no techniques and tools available to handle human subjectivity in conventional mathematical analysis and design of systems, it is either neglected or taken as a statistical/probabilistic uncertainty.

In this thesis an attempt has been made to study and analyse a few relevant problems of planning and management of educational systems in general and the Indian education system in particular, through the use of certain recent non-quantitative and quantitative techniques of system theory. The problems and issues studied and analysed are concerned with the technical education system, the continuing engineering education (CET) system and the school education system and

involve decision making, modelling and forecasting exercises. The techniques employed are the fuzzy-set theoretic method and the metagame theoretic method as part of non-quantitative systemic procedures and a quantitative method of estimation and prediction based on state variable modelling. In all, five specific problems have been considered. The first one concerns the selection of the most suitable form of instructional calendar for imparting education and training at the first degree level of the Indian Technical Education system. A fuzzy-set theoretic method based on responses of various interest-groups in terms of evaluation of different alternatives with regard to various associated features, has been used for selection of the "Optimal" alternative. The same method with suitable modifications is applied to the second problem of finding the most effective technology support system for CEE for practicing engineers and teachers of technical institutions. Another problem studied is the introduction of computer education in Indian schools, an issue of topical interest in India. Two aspects of the problem have been considered. The first one deals with issues of funding and implementation where a metagame theoretic approach is employed to find the most stable solution out of a number of relevant strategies of the concerned parties. The second one is an academic issue where again the fuzzy-set theoretic method is used to decide upon the best form of computer education at the school level. Lastly, the quantitative methods of large scale systems have been used to model the Indian School Education System

and make decentralized estimation and predictions at the component levels of this large system. The complete school education system is divided into four subsystems, namely, the primary, the middle, the secondary and the senior secondary school systems. Discrete time stochastic state variable models have been developed for each of the subsystems. Decentralized identification and estimation techniques based on linear least squares and Kalman filtering have been utilized for identification and prediction.

In all cases real-life data have been used for obtaining pragmatic results through systemic analysis.

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