THERMAL MODELLING OF BUILDINGS USING THERMAL CIRCUITS

By

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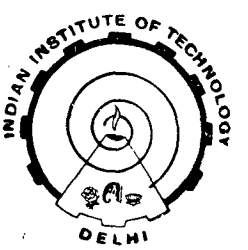
for the award of the degree of
DOCTOR OF PHILOSOPHY



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To

Ashok and Ankur

CERTIFICATE

It is certified that the thesis entitled "Thermal Modelling of Buildings using Thermal Circuits" being submitted by Kamana Pathak is worthy of consideration for the award of the degree of Doctor of Philosophy and is a record of the original bonafide research work carried out by her under our guidance and supervision. The results contained in this thesis have not been submitted in part or full to any other University or Institute for award of any degree or diploma.

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SUMMARY

This thesis presents some investigations on solar thermal modelling of buildings, some passive concepts for reducing heating/cooling load in buildings have been proposed and analysed by using thermal network analysis. The thermal performance of conditioned/non-conditioned building has been analysed by incorporating the effects of presence of window, effect of insulation, heat transfer due to ventilation and infiltration. The effect of putting insulations on ceiling/walls on the cooling load and indoor air temperature of building exposed to summer climate has been investigated. It is seen that maximum cooling is achieved when ceiling, east and west walls are well insulated. It is found that the cooling load in a conditioned enclosure is reduced by more than 40% as compared to a concrete enclosure. Cooling can be further improved by judicious choice of the rate and duration of ventilation for the temperature control in a building.

The annual indoor air temperatures of unconditioned enclosure have been compared with insulated enclosure. The performance of the later has further been studied with south facing ventilated Trombe wall, during winter months. The south facing glass has to be adequately shaded or white

painted in order to have comfortable indoor air temperature during summer months. Thermal performance of a multistorey building envelope has been carried out. The effect of factors like size, fenestration, aspect ratio etc. on the indoor air temperature of a multistorey building envelope has been analysed in detail. It is found that the minimum configuration in a multistorey building should be sixteen. The fenestration ratio of 5% and AR = 1 gives the optimum thermal performance.

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