

# Chapter 1

## Dynamic Template Generation

### ABSTRACT

*A test blueprint/test template, also known as the table of specifications, represents the structure of a test. It has been highly recommended in assessment textbook to carry out the preparation of a test with a test blueprint. This chapter focuses on modeling a dynamic test paper template using multi-objective optimization algorithm and makes use of the template in dynamic generation of examination test paper. Multi-objective optimization-based models are realistic models for many complex optimization problems. Modeling a dynamic test paper template, similar to many real-life problems, includes solving multiple conflicting objectives satisfying the template specifications.*

### TERMINOLOGY USED

The general terminology used in this chapter is briefly discussed in Table 1.

The Test paper Template (TPT) shown in Table 2 is a systematic design plan which lays out exactly how the test paper gets created.

The TPT with maximum marks (TM), distribution of unit/module weights ( $u_1, u_2, \dots, u_m$ ), distribution of cognitive levels weights ( $l_1, l_2, \dots, l_n$ ), etc. so suggested in the QPT Format in Table 3 above is expected to ensure that-

1. The weight given to each unit/module, ( $u_1, u_2, \dots, u_m$ ) in a test paper is appropriate, so that the important modules are not neglected.

Table 1. Terminology used for dynamic template generation

Term	Meaning
Course	Course is a Degree/Diploma program offered at a university. Example: 1. Bachelor of Science (Computer Science)-B.Sc (Comp.Sc.) 2. Bachelor of Computer Application -BCA
Subject	S is a subject/paper offered in different semesters of a course. Example: Software Engineering (SE) in 6 <sup>th</sup> Semester and Information Technology (IT) in 1 <sup>st</sup> Semester of B.Sc(Comp. Sc).
Modules/ Units	For each subject, there is a prescribed syllabus having different modules/units. A set of related topics is grouped as one unit/module. Each module is allotted a particular weightage. Example: Module on Software Requirement in SE subject has weightage of 30% in the 6 <sup>th</sup> semester of B.Sc (Comp. Sc).
Educational Taxonomy	A classification system of educational objectives based on level of student understanding necessary for achievement or mastery. Example- Benjamin Bloom, Solo etc.
m, n, TM	m, n, TM are the Instructor specified number of modules, number of levels and total marks respectively for generating a dynamic QPT.
Module ( $p_i$ )	$p_i$ is the $i^{th}$ module specified by Instructor for QPT, $p=<p_1, \dots, p_m>$
Taxonomy Level ( $q_j$ )	$q_j$ is the $j^{th}$ level specified by Instructor for QPT, $q=<q_1, \dots, q_n>$
Module Weight ( $u_i$ )	$u_i$ is the weight assigned to the $i^{th}$ module in the QPT
Level Weight ( $l_j$ )	$l_j$ is the weight assigned to the $j^{th}$ level in the QPT
Module-Level- Weight ( $x_{ij}$ )	$x_{ij}$ is the weight assigned to the $i^{th}$ module of $j^{th}$ level in the QPT
Question Paper Template (QPT) of maximum marks TM	QPT is an $m \times n$ matrix with rows representing Modules $p_i$ ( $i= 1$ to $m$ ), columns representing Educational Taxonomy Levels $q_j$ ( $j= 1$ to $n$ ), cells representing $i^{th}$ module of $j^{th}$ level $x_{ij}$ such that $\sum_{i=1}^m u_i = \sum_{j=1}^n l_j = TM$
$m^*, n^*, tm$	$m^*, n^*, tm$ are the Instructor specified number of modules, number of levels and total marks respectively for generating a scaled QPT.
Scaled Module- Level-Weight ( $x^*_{vw}$ )	$x^*_{vw}$ is the scaled weight assigned to the $v^{th}$ module of $w^{th}$ level.
Scaled Module Weight ( $u^*_v$ )	$u^*_v$ is the scaled weight assigned to the $v^{th}$ module
Scaled Level Weight ( $l^*_w$ )	$l^*_w$ is the scaled weight assigned to the $w^{th}$ level
Scaled QPT (qpt) of maximum marks tm	qpt is an $m^* \times n^*$ matrix generated from QPT by scaling its rows with respect to $m^*$ modules and scaling its columns with respect to $n^*$ levels such that $\sum_{v=1}^{m^*} u^*_v = \sum_{w=1}^{n^*} l^*_w = tm$

- The weightage of cognitive skills, ( $l_1, l_2, \dots, l_n$ ) tested are appropriate. For example, there are sufficient questions requiring application and understanding of logical reasoning.

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