

اعتبارات تصميم المسبوكات المعدنية وإنعكاساتها على جودة سطح المنتج  
(دراسة تحليلية على تطبيقات مقرر تكنولوجيا السباكة)

**Design considerations of metal castings and their impact on the quality of product surface**

**(Analytical study on the applications of casting Technology)**

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**Abstract:**

Metal casting operation is branch of Engineering Sciences, which use to development the basic technical skills that are necessary to preparing the designer of metal furniture and constructions. Because of their abundance and low costs, many students turn to implementation their applications by using sand casting method. This usually results many problems, especially in casting surfaces, which affect adversely at function and aesthetics of the products that produced by this method. These problems are due to by two reasons: 1<sup>st</sup> castings lacking to basic design criteria that did not take at design process, and 2<sup>ed</sup>, technical errors in the operations of: modeling, molding, melting, feeding, and solidification.

Although, it can solve many practical problem by some awareness and training for technicians, but it cannot solve design problems, unless the student learn how to following methodology and design criteria when he designing the castings. Hence, the research tries to prepare an analytical study to support the design criteria of metal castings with some technical limitations and engineering considerations, especially for sand casting products. This will provide innovative castings with most accurate results and high-quality of surfaces finishing, in the same time benefit of all advantages offered by mechanical, chemical or electrochemical methods in finishing operations.

Therefore, the **problem of research** stems from: metal product produced by sand mold casting are lacking of design considerations and technical determinants that are impact negatively on the quality and accuracy of product finishing. then, the problem of research stems from trying to answer the following questions. 1<sup>st</sup> What are the main problems faced students when designing products that produced by sand casting? 2<sup>ed</sup> what are the most important considerations to design, implement and finish metal castings with high quality? And 3<sup>ed</sup> is there a mechanism to measure the quality of finishing based on the quality of the design?

Accordingly, the main **aim of research** is based on introducing an analytical study about design considerations and technical determinants of metal castings and studying their impact on the quality of product finishing. This aim will be achieved according to Inference descriptive analytical **methodology** that contains **three topics**: 1<sup>st</sup> Casting Process (concepts and techniques), 2<sup>ed</sup> Surface Finishing Quality in Applications of Casting Technology Course (Analytical Study) & 3<sup>ed</sup> Design considerations for improvement of surface quality of metal castings

The research concluded with some results such as:

- The problems affecting the surface quality of castings vary, but most of them are under three main axes: (design problems, special problems of the material, problems with production methods and finishing)
- Cast defects are visible only after the mold has been frozen and removed from the mold. Proactive steps must be taken to avoid the expected problems to ensure the surface quality of cast
- The method of checking and optimizing castings depends on the nature of the characteristics and specifications to be obtained and the function for which they are designed. For example, the aesthetic characteristics are just examined by looking, and the structural characteristics need to be mechanical inspection before casting finishing
- The designer must be fully aware of the casting as a process of production and the problems that occur especially, which affect the quality of surface finishing in order to avoid these defects when starting to design and build the model
- When designing castings produced by sand casting, it is preferable to avoid sudden changes in thickness when designing different sections and take into consideration the gradual transition from large to small sections and the removal of high-walls as possible, and reducing communication between parts as much as possible
- When designing the cast and model, avoid sharp edges and corners and replace them with roundness, taking into account the dimensions of the holes and gaps, avoiding the sharp and straight angles and replacing them with angular angles
- Consider the addition of the necessary tolerances to the real dimensions represented in the shrinking thicknesses and finishing emphases which vary depending on the type of metal cast.
- Be as simple as possible and avoid complex forms