WORKSHOP / MANUFACTURING PRACTICES

WITH LAB MANUAL

Veeranna D. Kenchakkanavar

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ISBN: 978-93-91505-33-2
Book Code: UG006EN

Workshop/Manufacturing Practices

by Veeranna D. Kenchakkanavar
[English Edition]

First Edition: 2021

Published by:

Khanna Book Publishing Co. (P) Ltd.
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CIN: U22110DL1998PTC095547

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Printed in India.

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FOREWORD

Engineering has played a very significant role in the progress and expansion of mankind and society for centuries. Engineering ideas that originated in the Indian subcontinent have had a thoughtful impact on the world.

All India Council for Technical Education (AICTE) had always been at the forefront of assisting Technical students in every possible manner since its inception in 1987. The goal of AICTE has been to promote quality Technical Education and thereby take the industry to a greater heights and ultimately turn our dear motherland India into a Modern Developed Nation. It will not be inept to mention here that Engineers are the backbone of the modern society - better the engineers, better the industry, and better the industry, better the country.

NEP 2020 envisages education in regional languages to all, thereby ensuring that each and every student becomes capable and competent enough and is in a position to contribute towards the national growth and development.

One of the spheres where AICTE had been relentlessly working from last few years was to provide high-quality moderately priced books of International standard prepared in various regional languages to all it's Engineering students. These books are not only prepared keeping in mind it's easy language, real life examples, rich contents and but also the industry needs in this everyday changing world. These books are as per AICTE Model Curriculum of Engineering & Technology – 2018.

Eminent Professors from all over India with great knowledge and experience have written these books for the benefit of academic fraternity. AICTE is confident that these books with their rich contents will help technical students master the subjects with greater ease and quality.

AICTE appreciates the hard work of the original authors, coordinators and the translators for their endeavour in making these Engineering subjects more lucid.

(**Anil D. Sahasrabudhe**)

Acknowledgement

The author(s) are grateful to AICTE for their meticulous planning and execution to publish the technical book for Engineering and Technology students.

We sincerely acknowledge the valuable contributions of the reviewer of the book Prof. Manish Chaturvedi, for making it students' friendly and giving a better shape in an artistic manner.

This book is an outcome of various suggestions of AICTE members, experts and authors who shared their opinion and thoughts to further develop the engineering education in our country.

It is also with great honour that we state that this book is aligned to the AICTE Model Curriculum and in line with the guidelines of National Education Policy (NEP) -2020. Towards promoting education in regional languages, this book is being translated in scheduled Indian regional languages.

Acknowledgements are due to the contributors and different workers in this field whose published books, review articles, papers, photographs, footnotes, references and other valuable information enriched us at the time of writing the book.

Finally, we like to express our sincere thanks to the publishing house, M/s. Khanna Book Publishing Company Private Limited, New Delhi, whose entire team was always ready to cooperate on all the aspects of publishing to make it a wonderful experience.

Veeranna D Kenchakkanavar

Preface

The text book on "Workshop / Manufacturing Practices" is designed to cater the needs of young minds of 21st century. The Workshop is the place where the core of learning about different materials, equipment, tools and techniques. Basically the workshop is used to prepare the small components by hand/power tools. Sometimes they may be parts of the large machines or may be parts for replacement / repairs. The advancement in technology leads all technocrats and professionals to use the advanced tools and technology in manufacturing but without knowing the basics it becomes nothing. So in this text book an attempt has been made to connect the basic principles of workshop technology to advanced machine tools.

The theoretical and practical blend is achieved in all the topics of the content with relevant examples. The AICTE model curriculum is fallowed in designing the content of this text book. The New National Education Policy will become path breaker in the technical education; it demands to incorporate student centric and self learning activities in the curriculum. Such initiatives are very much incorporated here to make this book more meaningful and relevant to current scenario.

The text book will take you in five modules of theory in Part-A and laboratory experiments in Part-B separately. The **Unit-1** deals with the manufacturing methods like casting, forming, machining, joining and advanced machining processes. Many of the products what we use in day today basis may not be knowing their manufacturing processes. For example the alloy wheel of automobile, temple bell is made from casting! Such interesting examples are quoted to raise the curiosity of the readers. **Unit-2** deals with advanced manufacturing machineries like CNC machining and additive manufacturing. The 3D printing and rapid prototyping are discussed in length. The Fitting operations and Power tools is the one more topic in this module gives insights about hand tools to power tool usage in the workshop. **Unit-3** discusses about the electrical and electronic engineering, where the basics to applications were discussed. The electricity and its connectivity is explained with relevant applications. **Unit-4** will focus on carpentry, plastic moulding and glass cutting operations. The various industrial applications were discussed. **Unit -5** is meant for casting design, welding and brazing operations. The casting types and applications were discussed in detail. The welding and brazing applications and identification of the need is discussed elaboratively.

The text book is made according to the new generation readers; the relevant of each topic is discussed in sub title rationale of each topic. The interesting facts in each topic will tell you about unheard facts about that topic. The brief summary at the end of each module may give the instant glance of the content of that module. The video resources are added keeping in view of digital natives, who are well verse with the digital usage of the topics. The exercise is prepared with increasing order of Blooms taxonomy and in line with the AICTE exam reform document.

Although every care has been taken to avoid misprints and mistakes, yet it is difficult to claim perfection. I will be grateful to the readers if any errors are pointed out. Suggestions for further improvement of the book will be thankfully acknowledged.

Veeranna D. Kenchakkanavar

Outcome Based Education

For the implementation of an outcome based education the first requirement is to develop an outcome based curriculum and incorporate an outcome based assessment in the education system. By going through outcome based assessments evaluators will be able to evaluate whether the students have achieved the outlined standard, specific and measurable outcomes. With the proper incorporation of outcome based education there will be a definite commitment to achieve a minimum standard for all learners without giving up at any level. At the end of the programme running with the aid of outcome based education, a students will be able to arrive at the following outcomes:

PO-1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6 **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12 **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes

After completion of the course the students will be able to:

CO-1: Differentiate among the Manufacturing Methods like casting, forming, machining, joining and advanced manufacturing methods.

CO-2: Practice the CNC machining, classify different Additive manufacturing processes and perform various fitting operations using hand/power tools.

CO-3: Make electric circuits and comment on basic Electrical & Electronics components.

CO-4: Demonstrate the usage of Carpentry, Plastic moulding and glass cutting operations and related tools.

CO-5: Practice of Metal casting operations and various Welding (arc welding & gas welding), brazing operations.

Mapping of Course Outcomes with Programme Outcomes to be done according to the matrix given below:

Course Outcome	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1												
CO-2												
CO-3												
CO-4												
CO-5												

Abbreviations and Symbols

Symbol	Details
A	Semi taper angle
D	Diameter of work piece
I	Current
K	Conicity
L	Length of taper
N	Spindle speed
P	Power
R	Resistance
V	Cutting Speed
V	Volt
d1	Original diameter of the work piece
d2	Final diameter of the work piece
t	Depth of cut
α	Semi taper angle
ρ	Specific resistance

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Unit 3: Electrical and Electronics

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Unit 5: Metal Casting Welding Brazing

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Guidelines for Teachers

To implement Outcome Based Education (OBE) knowledge level and skill set of the students should be enhanced. Teachers should take a major responsibility for the proper implementation of OBE. Some of the responsibilities (not limited to) for the teachers in OBE system may be as follows:

- Within reasonable constraint, they should manipulate time to the best advantage of all students.
- They should assess the students only upon certain defined criterion without considering any other potential ineligibility to discriminate them.
- They should try to grow the learning abilities of the students to a certain level before they leave the institute.
- They should try to ensure that all the students are equipped with the quality knowledge as well as competence after they finish their education.
- They should always encourage the students to develop their ultimate performance capabilities.
- They should facilitate and encourage group work and team work to consolidate newer approach.
- They should follow Blooms taxonomy in every part of the assessment.

Bloom's Taxonomy

Level	Teacher should Check	Student should be able to	Possible Mode of Assessment
Creating	Students ability to create	Design or Create	Mini project
Evaluating	Students ability to Justify	Argue or Defend	Assignment
Analysing	Students ability to distinguish	Differentiate or Distinguish	Project/Lab Methodology
Applying	Students ability to use information	Operate or Demonstrate	Technical Presentation/ Demonstration
Understanding	Students ability to explain the ideas	Explain or Classify	Presentation/Seminar
Remembering	Students ability to recall (or remember)	Define or Recall	Quiz

Guidelines for Students

Students should take equal responsibility for implementing the OBE. Some of the responsibilities (not limited to) for the students in OBE system are as follows:

- Students should be well aware of each UO before the start of a unit in each and every course.
- Students should be well aware of each CO before the start of the course.
- Students should be well aware of each PO before the start of the programme.
- Students should think critically and reasonably with proper reflection and action.
- Learning of the students should be connected and integrated with practical and real life consequences.
- Students should be well aware of their competency at every level of OBE.

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