

Content:

1. Materials in Engineering.....	7
1.1. Metals.....	7
1.1.1. Crystalline Structure of Metals.....	7
1.1.2. Technical Ferrous Alloys.....	8
1.1.3. Non-ferrous Alloys.....	13
2. Metal Casting.....	14
2.1. History of Casting	14
2.2. Introduction.....	15
2.3. Properties of Foundry Alloys	16
2.3.1. Foundry Properties.....	17
2.4. Casting Methods.....	19
2.4.1. Sand Casting Technologies	20
2.4.2. Die Casting Technologies.....	23
2.4.3. Centrifugal Technologies.....	26
2.4.4. Other Casting Methods	27
2.5. Casting Vocabulary	30
3. Metal Forming.....	32
3.1. Bulk Deformation Processes.....	35
3.2. Sheet-Forming Processes	35
3.2.1. Rolling.....	35
3.2.2. Rolling Equipment	37
3.3. Forging.....	40
3.3.1. Smith Forging.....	41
3.3.2. Drop Forging.....	42
3.3.3. Open-die Drop Forging	42
3.3.4. Impression Die Forging.....	43
3.3.5. Press Forging	45
3.3.6. Upset Forging	45
3.3.7. Roll Forging.....	46
3.3.8. Forging Machines	46
3.4. Extrusion.....	47
3.4.1. Direct Extrusion	47
3.4.2. Indirect Extrusion	48
3.5. Wire and Bar Drawing	49

3.6.	Tube Drawing	49
3.7.	Sheet Metal Working.....	50
3.7.1.	Shearing.....	50
3.7.2.	Deep Drawing	53
3.7.3.	Stretch Forming.....	54
3.7.4.	Spinning.....	55
3.7.5.	Rubber Pad Forming.....	55
3.7.6.	Bending.....	55
3.7.7.	Explosive Forming.....	56
3.8.	Forming Terms.....	58
4.	Welding.....	62
4.1.	History	62
4.2.	Introduction.....	62
4.3.	Basic Terms of Welding	63
4.4.	Types of Welds	64
4.5.	Weldability	65
4.6.	Welding Process	66
4.7.	Positions of Welding.....	66
4.8.	Welding Processes.....	67
4.8.1.	Fusion Welding	67
4.8.2.	Pressure Welding.....	70
4.8.3.	Unique Welding.....	73
4.9.	Oxyfuel Gas Welding	75
4.9.1.	Gases for Oxyfuel Gas Welding	75
4.9.2.	Gas Cylinders	75
4.9.3.	Cylinder Valves	77
4.9.4.	Hoses	77
4.9.5.	Welding Torch	77
4.9.6.	Welding Flame.....	78
4.9.7.	Oxyfuel Gas Welding Techniques	79
4.10.	Electric Arc Welding	80
4.10.1.	Nature of the Arc.....	80
4.10.2.	Arc Welding Equipment.....	82
4.10.3.	Classification of Sources:.....	82
4.10.4.	Electrodes.....	83
4.10.5.	Manual Metal Arc Welding Technique.....	83

4.10.6.	Influence of Welding Parameters.....	83
4.10.7.	Edge Preparation	84
4.11.	Thermal Cutting.....	84
4.12.	Brazing and Soldering.....	84
4.13.	Brazing	86
4.14.	Soldering.....	87
4.15.	Discontinuity of Welds	87
4.16.	Welding Terms.....	89
5.	Used and Recommended Literature	91
5.1.	Materials in Engineering.....	91
5.2.	Casting	91
5.3.	Forming	91
5.4.	Welding	92