

CONTENTS

LIST OF SYMBOLS AND DESIGNATIONS	5
INTRODUCTION	6
THE BASIC CONCEPTS OF STATICS.....	10
1.1 The laws of mechanics.....	10
1.2 Rigid body and the material point.....	12
1.3 The concept of force	13
1.4 Types of forces.....	15
1.5 External and internal forces.....	17
1.6 The rules of statics	19
1.7 The degrees of freedom, constraints	24
1.8 Release from constraints.....	25
1.9 Catalogue of supports.....	26
FORCE SYSTEM IN A STRAIGHT LINE	31
2.1 Addition of identically directed forces.....	31
2.2 Addition of oppositely directed forces	31
2.3 The resultant of a force system in a straight line	32
2.4 Equilibrium conditions of forces in a straight line	33
2.5 The principles to be followed in solving equilibrium tasks.....	33
2.6 Examples of tasks for the system of forces on a straight line.....	36
PLANAR SYSTEM OF CONVERGENT FORCES.....	41
3.1 Force projection on an axis.....	41
3.2 Force in the Cartesian system of coordinates.....	42
3.3 A resultant of a planar system of convergent forces.....	43
3.4 Equilibrium conditions of a planar system of convergent forces.....	47
3.5 The equilibrium of three nonparallel forces	48
3.6 The methodology of solving equilibrium problems.....	49
3.7 Examples of tasks for planar systems of convergent forces	54
ARBITRARY PLANAR SYSTEM OF FORCES.....	68
4.1 Moment of a force about a point	68
4.2 Reduction of a planar system of forces to any point.....	76
4.3 Equilibrium of a planar system of forces	77
4.4 Systems of coordinate axes	78
4.5 Planar system of parallel forces	78
4.6 Ritter's method.....	81
4.7 Examples of tasks for the planar system of forces.....	83

FRICION AND ROLLING RESISTANCE.....	98
5.1 Sliding friction.....	98
5.2 Friction of a tie against a drum	108
5.3 Rolling resistance.....	111
5.4 Examples of tasks for a planar system of forces with friction.....	115
A SYSTEM OF CONVERGENT FORCES IN SPACE	121
6.1 Force description in the Cartesian spatial system of coordinates.....	121
6.2 Equilibrium of the spatial system of parallel forces.....	124
6.3 Examples of tasks for the spatial system of convergent forces	127
SPATIAL FREE SYSTEM OF FORCES	131
7.1 Moment of a force in space	131
7.2 Reduction of a free system of forces in space	139
7.3 The conditions of equilibrium for spatial system of forces	142
7.4 Examples of spatial exercises of any force systems.....	144
STATICALLY DETERMINATE AND INDETERMINATE TASKS	147
8.1 Planar issues	148
8.2 Spatial issues.....	149
CENTRES OF GRAVITY	151
9.1 Reduction of the spatial system of parallel forces.....	151
9.2 The centre of gravity of solids	153
9.3 Centres of gravity of planar shapes.....	156
9.4 The centre of gravity of a line given in space	161
9.5 Method of calculation of gravity centre coordinates	163
9.6 Examples of tasks for gravity centre designation	167
9.7 Gravity centres of basic geometric figures	172
THE CENTRE OF BUOYANCY.....	178
10.1 Designation of the centre of buoyancy	178
10.2 The centre of buoyancy of a rectangular pontoon.....	180
THE EQUILIBRIUM OF TIES - ROPES.....	191
11.1 Rope equilibrium conditions.....	191
11.2 The rope equilibrium form – rope curve.....	194
11.3 Chain curve	195
Appendix	
ELEMENTARY INFORMATION FROM THE VECTOR CALCULUS.....	207
Jan Szmelter – the late co-author	218
Fathers of mechanics and their works.....	220
Literature	221