Contents

INTRODUCTION	6	MATERIALS TECHNOLOGY
DESIGN 1 Drawings A Drawing types and scales	8	11 Material types 28 A Metals and non-metals B Elements, compounds and mixtures C Composite materials
B Types of views used on drawings 2 Design development A Initial design phase B Collaborative development	10	12 Steel 30 A Carbon steels B Alloy steels C Corrosion
3 Design solutions A Design objectives B Design calculations	12	13 Non-ferrous metals 32 A Common non-ferrous engineering metals B Plating with non-ferrous metals
MEASUREMENT 4 Horizontal and vertical		14 Polymers 34 A Natural and synthetic polymers B Thermoplastics and thermosetting plastics
measurements A Linear dimensions B Level and plumb	14	Minerals and ceramics A Mineral and ceramic engineering materials
A Centrelines and offsets B Grids	16	B Glass 16 Concrete A Concrete mix design
6 Dimensions of circles A Key dimensions of circles B Pipe dimensions	18	B Reinforced concrete 17 Wood 40 A Categories of wood
7 Dimensional accuracy A Precision and tolerance B Fit	20	B Solid structural timber C Engineered wood
8 Numbers and calculations A Decimals and fractions B Addition, subtraction, multiplication and division	22	18 Material properties 1 42 A Tensile strength and deformation B Elasticity and plasticity C Stages in elastic and plastic deformation
9 Area, size and mass A Area B Weight, mass, volume and density	24	19 Material properties 2 A Hardness B Fatigue, fracture toughness and creep C Basic thermal properties
10 Measurable parameters A Supply, demand and capacity B Input, output and efficiency	26	steering properties

20	Forming, working and		STATIC AND DYNAMIC PRINCIPL	.ES
А	heat-treating metal Casting, sintering and extruding metal Working metal	46	30 Load, stress and strain A Load B Stress and strain	66
21	Heat-treating metal Material formats Raw materials for processing	48	31 Force, deformation and failure A Types of force and deformation	68
В	Formats of processed materials NUFACTURING AND ASSEME	nv	B Types of failure 32 Structural mechanics	70
22	3D component features 3D forms of edges and joints 3D forms of holes and fasteners	50	A Statically determinate structures B Resultant forces and centre of gravity C Frames and trusses	
23 A B	Machining 1 Machining and CNC Machining with cutting tools	52	33 Motion and simple machines A Acceleration and motion B Inertia	72
A B	Machining 2 Guillotining and punching High-temperature metal cutting techniques Laser cutting and UHP waterjets Interconnection	54	C Simple machines 34 Moving parts A Angular motion B Rotary and reciprocating motion C Engine revs	74
A	Attaching and supporting Fitting together	56	D Friction ENERGY AND TEMPERATURE	
A B	Mechanical fasteners 1 Bolts Preload in bolted joints Washers	58	35 Energy A Forms of energy B Energy efficiency C Work and power	76
A B	Mechanical fasteners 2 Screws Screw anchors Rivets	60	36 Heat and temperature A Changes of temperature and state B Heat transfer	78
Α	Non-mechanical joints 1 Welding Common gas and arc welding techniques	62	FLUIDS 37 Fluid containment A Pipes, ducts and hoses B Tanks C Pumps, fans and turbines	80
A B	Non-mechanical joints 2 Specialized welding techniques Brazing and soldering Adhesives	64	38 Fluid pressure A Gauge pressure and absolute pressure B Hydrostatic pressure and siphonic action	82

	39 Fluid dynamics A Fluid dynamics and aerodynamics B Drag C Laminar flow and turbulent flow D Aerofoils	84	Appendix I Three-dimensional drawings	98
B C			Appendix II Shapes	99
MEG	CHANISMS		Appendix III Units of measurement	100
	Engines and motors Types and functions of engines and motors	86	Appendix IV Chemical elements	104
	Internal combustion engines Transmission 1	88	Appendix V Structural elements and types of load	106
В	Gears Gear ratios Types of gear wheel		Appendix VI Moments	108
	Transmission 2 Chains, sprockets and pulleys	90	Appendix VII Vapour, cooling and thermal inertia	109
В	B Conversion between reciprocating and rotary motion		Appendix VIII The electromagnetic spectrum	110
ELE(CTRICITY		Appendix IX	111
43	Current, voltage and		Pipe and hose fittings and valves	
	resistance Electric current Voltage and resistance	92	Appendix X Siphonic action	112
	Electrical power	-1	Appendix XI	113
44	Electrical supply	94	Managing rotary motion	
	Direct current and alternating current AC generation and supply		Appendix XII Electrical and electronic components	114
	DC generation and use		Appendix XIII	118
	Circuits and components A Simple circuits	96	Sensing, measuring and regulating devices	
B Mains AC circuits and switchboards C Printed and integrated circuits D Electrical and electronic components		Answer key	119	
		Index	130	
			Acknowledgements	143