TABLE OF CONTENTS

Sl. No.		Chapter	Page No
Part 1		Foundations of Generative AI	1
1.1	Introdu	3	
	1.1.1	Scope of Generative AI	5
	1.1.2	Evolution of Generative AI	7
	1.1.3	Key Concepts of Generative AI	9
	1.1.4	Traditional AI vs GenAI	12
1.2	Core C	15	
	1.2.1	Neural Networks	17
	1.2.2	Transformers	20
	1.2.3	Diffusion Models	23
	1.2.4	Learning Paradigms	26
	1.2.5	Supervised Learning	29
	1.2.6	Unsupervised Learning	33
	1.2.7	Reinforcement Learning	35
1.3	Archite	37	
	1.3.1	Large Language Models(LLMs)	39
	1.3.2	Vision Models	42
	1.3.3	Pre-Training	44
	1.3.4	Fine-tuning	46
	1.3.5	Model Alignment	47
1.4	Multin	49	
	1.4.1	Integrating Text & Images	50
	1.4.2	Integrating Audio & Video	52
	1.4.3	Integrating Code	55
Part 2	Buildi	ng GenAI and Autonomous Systems	57
2.1	Model Development Workflows		59
	2.1.1	Data Preparation	61
	2.1.2	Tokenization	65
	2.1.3	Training Pipelines	68
	2.1.4	Model Optimization	72
	2.1.5	Deployment Strategies	<i>7</i> 5

2.2	Promp	t Engineering and Customization	78
	2.2.1	Prompt Design for Different Modalities	81
2.3	AI Agent Design and Workflow Creation		
	2.3.1	Fundamentals of AI Agents: Definitions and	87
		Capabilities	
	2.3.2	Planning, Reasoning, and Tool Use	91
	2.3.3	Building Multi-Step Task Agents (e.g., AutoGPT,	94
		BabyAGI, OpenAI Assistants API)	
	2.3.4	Designing Goal-Oriented Agent Workflows	98
2.4	Evaluating Generative and Agent Systems		
	2.4.1	Metrics for Creativity, Reasoning, and Task Success	102
	2.4.2	Human-in-the-Loop Evaluation Techniques	106
Part 3	Applic	ations and Case Studies	110
3.1	Creativ	ve Industries	113
	3.1.1	Content Generation in Art, Music	116
	3.1.2	Content Generation in Literature	120
3.2	Scientific Discovery		122
	3.2.1	Accelerated Research through GenAI Agents	125
3.3	Enterprise Transformation		
	3.3.1	Automating Knowledge Workflows and Enhancing Productivity	131
3.4	Education and Personalized Learning		
	3.4.1	AI Agents for Customized Learning Experiences	141
Part 4	Challe	nges and Future Frontiers	147
4.1	Ethical and Societal Implications		
	4.1.1	Bias and Safety	157
	4.1.2	Accountability in Autonomous Systems	176
4.2	Policy,	Governance, and Regulation	186
	4.2.1	Frameworks for Responsible AI Development	189
4.3	Technical Barriers and Sustainable AI		
	4.3.1	Energy Efficiency and Scaling Challenges	198
4.4	Future	Horizons	201
	4.4.1	Autonomous Agents	203
	4.4.2	Long-Term Memory	208
	4.4.3	Pathways to AGI	214