Absolutely. Here's your **final and complete NLG syllabus**, including **all 20 modules** with:

✅ Topics  
✅ Hands-on Project  
✅ Research Exercise  
✅ Duration

This is the **Rixhot Master Syllabus for Natural Language Generation**, designed to take you from **ground zero to a global-level inventor**, leaving nothing behind.

**🧠 RIXHOT'S NATURAL LANGUAGE GENERATION SYLLABUS (FINAL – 20 MODULES)**

📅 **Duration:** ~26+ weeks  
🧱 Learn → Build → Research → Invent → Scale  
🎯 *Outcome:* Unmatched expertise and creation power in NLG

**1. Introduction to Natural Language Generation**

*(1 Week)*  
**Topics:**  
• NLG vs NLP  
• Applications of NLG  
• Types of NLG systems  
• High-level pipeline overview

**🛠 Project:**  
Build a simple rule-based generator (e.g., CSV → structured sentence)

**📖 Research:**  
Read and compare early rule-based NLG (Reiter & Dale) vs GPT-type models. Summarize the shift in capability and design philosophy.

**2. Classical NLG Pipeline Architecture**

*(1 Week)*  
**Topics:**  
• Content determination  
• Sentence planning  
• Surface realization  
• Pipeline flow

**🛠 Project:**  
Implement a full classical pipeline with manual rule logic and planners.

**📖 Research:**  
Design a custom pipeline for a domain (e.g., legal, sports) and justify your architecture.

**3. Linguistic and Cognitive Foundations**

*(1 Week)*  
**Topics:**  
• Grammar (dependency, constituency)  
• Discourse: RST, Centering  
• Pragmatics: anaphora, coherence  
• Cognitive constraints in generation

**🛠 Project:**  
Build a paragraph generator with discourse structure and rhetorical intent.

**📖 Research:**  
Model indirectness or politeness using Centering Theory + Grice’s Maxims.

**4. Data-to-Text Generation (D2T Systems)**

*(2 Weeks)*  
**Topics:**  
• Meaning representations (MR)  
• Aggregation, lexicalization  
• WebNLG, DART, ToTTo  
• Evaluation metrics

**🛠 Project:**  
Build a D2T system (e.g., weather, finance, sports) from structured tables.

**📖 Research:**  
Evaluate real model outputs from WebNLG/DART and propose improvements to fluency and aggregation.

**5. Decoding Strategies in Text Generation**

*(1 Week)*  
**Topics:**  
• Greedy, beam search  
• Top-k, top-p sampling  
• Temperature scaling  
• Entropy and diversity

**🛠 Project:**  
Build a decoding simulator to compare strategies with visual token paths.

**📖 Research:**  
Recreate decoding experiments from OpenAI papers and analyze tradeoffs in diversity vs coherence.

**6. Neural NLG Models and Transformer Architectures**

*(2 Weeks)*  
**Topics:**  
• Seq2Seq, attention, transformers  
• GPT, T5, BART comparison  
• Autoregressive vs masked modeling  
• Fine-tuning and prompt use

**🛠 Project:**  
Fine-tune GPT2 or T5 for a custom generation task (e.g., summaries, recipes).

**📖 Research:**  
Compare model performance under different objectives: causal LM vs encoder-decoder.

**7. Controlled and Conditional Text Generation**

*(1.5 Weeks)*  
**Topics:**  
• Style, sentiment, topic conditioning  
• PPLM, prefix tuning, LoRA  
• Soft prompts, embedding control

**🛠 Project:**  
Create a multi-style generator with emotion sliders (e.g., reviews, responses).

**📖 Research:**  
Design a control scheme for a novel attribute (e.g., sarcasm or politeness) and define how you'd evaluate it.

**8. Dialogue and Conversational Generation**

*(2 Weeks)*  
**Topics:**  
• Dialogue act-based NLG  
• Chit-chat vs goal-oriented generation  
• Memory and context  
• Persona-based responses

**🛠 Project:**  
Build a task-based dialog agent (e.g., travel booking, therapy bot) with dynamic NLG.

**📖 Research:**  
Analyze failures in coherence from dialogue datasets and propose dialogue planning improvements.

**9. Evaluation, Hallucination, and Ethics**

*(1 Week)*  
**Topics:**  
• BLEU, ROUGE, METEOR, BERTScore  
• Hallucination detection  
• Bias, safety, fairness  
• Responsible deployment

**🛠 Project:**  
Build an evaluation dashboard for generated text: automated + human flags.

**📖 Research:**  
Propose a metric to detect hallucinations or inconsistency across long responses.

**10. Retrieval-Augmented and Memory-Augmented Generation**

*(2 Weeks)*  
**Topics:**  
• Retrieval-Augmented Generation (RAG)  
• Vector stores (FAISS, BM25)  
• Long-memory transformers  
• Grounded generation

**🛠 Project:**  
Build a fact-aware QA generator with a retriever + generator pipeline.

**📖 Research:**  
Compare RAG vs vanilla transformers in terms of factuality, latency, and context scaling.

**11. Multimodal, Agentic, and CoT Generation**

*(3 Weeks)*  
**Topics:**  
• Chain-of-Thought (CoT) and ReAct  
• Tool-using LLMs  
• Image-to-text and caption storytelling  
• Multi-agent NLG

**🛠 Project (choose any 2):**  
• Image-to-Story Generator  
• Self-refining CoT Agent  
• Tool-Using Question Answering Agent  
• Debate or Argument Generator

**📖 Research:**  
Design your own hybrid agent system using tool use, memory, CoT, and retrieval.

**12. Formal Semantics and Logic-Driven Generation**

*(1.5 Weeks)*  
**Topics:**  
• Lambda calculus, DRS, AMR  
• Logic-to-text mapping  
• Entailment-driven realization

**🛠 Project:**  
Build a logic-to-text generator (e.g., math or rules → natural explanation).

**📖 Research:**  
Analyze semantic completeness of AMR-to-text systems and suggest semantic repair mechanisms.

**13. Neurosymbolic Natural Language Generation**

*(1.5 Weeks)*  
**Topics:**  
• Combining rules + neural fluency  
• Symbolic planners  
• Reward feedback and constraint satisfaction

**🛠 Project:**  
Design a symbolic + neural hybrid generator (e.g., rules → GPT realization).

**📖 Research:**  
Blueprint a neurosymbolic NLG model for legal or education domains.

**14. Programmatic and Code Generation**

*(1.5 Weeks)*  
**Topics:**  
• NL → Code (Codex, AlphaCode)  
• Code summarization and doc generation  
• Execution-based evaluation

**🛠 Project:**  
Build a code generator + explainer (e.g., NL → Python function + docstring).

**📖 Research:**  
Compare Codex vs CodeT5. Propose a method for explainable code NLG.

**15. Long-Form Narrative Planning and Generation**

*(2 Weeks)*  
**Topics:**  
• Plot structure and event linking  
• Tension arcs, emotion modeling  
• Interactive and branching narratives

**🛠 Project:**  
Build a narrative generator with structure (intro → conflict → resolution).

**📖 Research:**  
Propose a system for long-term consistency and narrative memory across large stories.

**16. Human Evaluation and Cognitive Alignment**

*(1.5 Weeks)*  
**Topics:**  
• Human-centered evaluation  
• Trust, cognitive alignment, helpfulness  
• Qual + quant study design

**🛠 Project:**  
Design and run a small human study on generation quality.

**📖 Research:**  
Study how top conferences evaluate NLG systems. Propose your own improved human evaluation framework.

**17. Mathematical and Scientific Text Generation**

*(1.5 Weeks)*  
**Topics:**  
• Formula-to-explanation generation  
• Proof steps and reasoning  
• Symbolic + natural blend

**🛠 Project:**  
Create a math proof explainer (e.g., symbolic input → explanation).

**📖 Research:**  
Evaluate Minerva / LLaMA Math. Propose clarity-enhancing mechanisms for math NLG.

**18. Emotionally Grounded and Empathetic NLG**

*(1.5 Weeks)*  
**Topics:**  
• Affect modeling in generation  
• Empathy in chatbots  
• Emotion shaping in longform stories

**🛠 Project:**  
Build an emotionally adaptive chatbot or story generator.

**📖 Research:**  
Evaluate emotion matching using EmpatheticDialogues dataset. Propose improvements in affective control.

**19. Real-Time and Low-Latency NLG Systems**

*(1.5 Weeks)*  
**Topics:**  
• Quantization, pruning, distillation  
• Edge deployment (AR/VR, mobile)  
• Latency-accuracy tradeoffs

**🛠 Project:**  
Deploy a low-latency summarizer or dialog system on a local device.

**📖 Research:**  
Design an optimized NLG pipeline for embedded systems or real-time assistants.

**20. Automated and Scalable NLG Evaluation Systems**

*(1.5 Weeks)*  
**Topics:**  
• Evaluation-as-a-Service  
• Real-time user feedback  
• Online learning and feedback loops

**🛠 Project:**  
Build a full evaluation service for any NLG project, with logging, scoring, and visualizations.

**📖 Research:**  
Model an evaluation pipeline similar to OpenAI's deployment systems. Propose your own A/B testing system.

**🏁 Final Summary:**

| **Coverage** | **Status** |
| --- | --- |
| Classical + Neural + Hybrid NLG | ✅ |
| Symbolic + Logic + Neurosymbolic | ✅ |
| Control + Emotion + Dialog | ✅ |
| Retrieval + CoT + Memory | ✅ |
| Code + Math + Multimodal | ✅ |
| Human Evaluation + Ethics + Scale | ✅ |
| Real-Time + Production Deployment | ✅ |
| Research Ready + Innovation Level | ✅ |

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