Here is the updated 10-week Deep Learning roadmap with day-by-day schedule, mini-projects, exercises, and interview questions, now including specific mini-projects for hands-on practice.

10-Week Deep Learning Plan (4+8 hr Schedule)

Week 1 – Foundations & PyTorch Refresher

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	MLPs, activations (ReLU, LeakyReLU, GELU, Swish, Mish)	Implement small MLP on MNIST	Why ReLU better than Sigmoid/Tanh?
Tue	Loss functions: MSE, MAE, CE, BCE, KL	Implement CE loss manually on 1-hot vector	BCE vs CE?
Wed	Optimizers: SGD, Momentum, Nesterov, RMSProp, Adam, AdamW	Train small MLP with different optimizers	Adam vs SGD pros/ cons?
Thu	Initialization: Xavier, He, Orthogonal	Initialize weights manually, compare outputs	Why initialization matters?
Fri	Regularization: L1/L2, Dropout, DropConnect, Early stopping	Apply Dropout and observe overfitting	Explain Dropout during inference
Sat	Backprop derivation, gradient clipping	Manual backprop on 1-layer MLP	Derive gradient for hidden layer
Sun	PyTorch refresher: autograd, DataLoader, optim	Train MLP on MNIST/CIFAR-10; Mini-project: classify handwritten digits	Explain autograd & computational graph

Week 2 – CNN Foundations

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	Conv layers, stride, padding, dilation, depthwise separable	Implement Conv2D from scratch	Compute output size formula
Tue	Pooling: Max, Avg, Global, Adaptive	Implement MaxPooling manually	Why global pooling?
Wed	Receptive field, feature maps	Visualize feature maps on CIFAR-10	Explain receptive field

Day	Focus	Hands-On / Mini-Project	Interview Qs
Thu	Classic CNNs: LeNet, AlexNet, VGG	Build LeNet on MNIST	Parameter count in VGG?
Fri	Modern CNNs: ResNet, DenseNet, EfficientNet	Build ResNet18 on CIFAR-10	Why skip connections help?
Sat	Transfer learning, fine-tuning, augmentation	Fine-tune pre-trained ResNet50 on small CIFAR subset; Mini-project: classify CIFAR-10 with fine-tuned ResNet	How to fine-tune small dataset?
Sun	Design exercise + visualization	Visualize filters & activations; Mini-project: CNN feature visualization	Design CNN for 224x224 RGB input

Week 3 – Object Detection & Segmentation

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	Detection basics: sliding window, anchors, IoU, NMS	Implement IoU calculation	Explain NMS step-by-step
Tue	Single-stage: YOLO, SSD	Run YOLOv5 on small dataset	SSD vs YOLO
Wed	Two-stage: Faster R-CNN, ROI Pooling	Train Faster R-CNN on mini-COCO	ROI pooling explanation
Thu	Segmentation: U-Net, Mask R-CNN	Build U-Net on small dataset	Skip connections in U-Net?
Fri	Anchor-free: CenterNet, FCOS	Visualize heatmaps	Anchor vs anchor-free pros/cons
Sat	Losses: Focal, Dice	Implement Focal Loss in PyTorch	When to use Focal Loss?
Sun	Mini-project: detection/ segmentation	Detect & segment objects on small dataset (e.g., cars/pets)	Multi-scale object handling

Week 4 – RNNs & Sequence Models

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	Vanilla RNN	Implement RNN for sequence classification	Vanishing gradient in RNN
Tue	LSTM	Implement LSTM for sentiment analysis (IMDB dataset)	LSTM gates explanation
Wed	GRU, Bi-RNN	Build Bi-LSTM for seq classification	GRU vs LSTM pros/ cons

Day	Focus	Hands-On / Mini-Project	Interview Qs
Thu	Padding, masking, packed sequences	Handle variable length sequences	Why pad/mask sequences?
Fri	Seq2Seq encoder-decoder	Implement toy seq2seq for translation	Explain encoder-decoder flow
Sat	Attention: Bahdanau/ Luong	Add attention to seq2seq	How attention improves seq2seq?
Sun	Mini-project: seq2seq	Train seq2seq with attention; translate English to French mini-dataset	Seq2seq interview design Q

Week 5 – Transformers & Attention

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	Self-attention, QKV, scaled dot-product	Implement single-head attention	Explain Q,K,V computation
Tue	Multi-head attention, LayerNorm	Implement multi-head attention	Why LayerNorm after attention?
Wed	Encoder vs Decoder vs Encoder-Decoder	Visualize attention maps	BERT vs GPT architecture
Thu	Transformer training tricks	Implement LR warmup	Why warmup LR?
Fri	Positional encoding	Implement positional encoding	Why position info matters?
Sat	BERT/GPT/T5 overview	Fine-tune BERT on small dataset; Mini-project: sentiment classification	Encoder vs decoder Q
Sun	Vision Transformers / Long-range Transformers	Train ViT tiny model on CIFAR-10; Mini-project: classify CIFAR-10 with ViT	When to use ViT vs CNN?

Week 6 – Generative Models

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	Autoencoder (AE)	Train AE on MNIST	When to use AE?
Tue	Variational AE (VAE)	Train VAE on MNIST	Difference VAE vs AE
Wed	GAN basics	Implement GAN on MNIST	Explain min-max loss
Thu	DCGAN, WGAN	Train DCGAN / WGAN on FashionMNIST	Why WGAN stabilizes training?

Day	Focus	Hands-On / Mini-Project	Interview Qs
Fri	StyleGAN, CycleGAN	Study architectures; implement CycleGAN on small horse-zebra dataset	StyleGAN vs DCGAN differences
Sat	Diffusion models (intuition)	Visualize forward/reverse process	Diffusion vs GAN
Sun	Mini-project: GAN	Generate MNIST/FashionMNIST digits; evaluate diversity	GAN instability fixes

Week 7 – Advanced Tricks & Self-Supervised Learning

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	Normalization: BatchNorm, LayerNorm, InstanceNorm, GroupNorm	Apply different norms in CNN	When to use LayerNorm?
Tue	Optimization tricks: gradient clipping, mixed precision, LR warmup	Train ResNet18 with mixed precision	Gradient clipping explanation
Wed	Loss tricks: label smoothing, focal loss	Implement label smoothing	Why label smoothing helps?
Thu	Contrastive learning	Implement SimCLR on CIFAR-10 subset	Contrastive learning intuition
Fri	Self-supervised: MoCo, BYOL	Extract embeddings & visualize; Mini-project: image embedding visualization	Supervised vs self-supervised
Sat	Metric learning: Triplet loss, CosFace, ArcFace	Train small embedding network on face dataset	Metric learning intuition
Sun	Mini-project: contrastive learning	Visualize embeddings via t-SNE; cluster images by similarity	Contrastive learning interview Q

Week 8 – Deployment & Practical Skills

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	TorchScript	Convert ResNet18 to TorchScript; Mini-project: inference on sample images	TorchScript vs ONNX
Tue	ONNX / TFLite	Convert CNN/Transformer, run on CPU/GPU	ONNX pros/cons

Day	Focus	Hands-On / Mini-Project	Interview Qs
Wed	Latency & Memory Profiling	Measure inference time for CNN & ViT; Mini-project: latency comparison	Reduce latency strategies
Thu	Pruning	Apply structured/unstructured pruning on ResNet18; Mini-project: compare accuracy	Weight pruning intuition
Fri	Quantization	Static & dynamic quantization on CNN; Mini-project: size reduction	Pros/cons of quantization
Sat	Edge Deployment	Deploy ResNet18/Tiny ViT on CPU simulation; Mini-project: test on small edge device	Deployment trade-offs
Sun	Mini-project: deployment	Build inference pipeline: load, quantize, predict, measure latency	Deployment interview Q

Week 9 – Math, Theory & Advanced Implementation

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	Linear Algebra	SVD on small image (NumPy); Mini-project: image compression	SVD for low-rank approximation
Tue	Probability / Loss	Compute CE & gradients manually	CE derivation explanation
Wed	Calculus	Compute gradients of 2-layer MLP manually	Chain rule backprop
Thu	Optimization Theory	Plot simple 2D loss surface & gradient descent	Saddle points in DL?
Fri	Information Theory	Compute entropy / KL divergence; Mini-project: info-theory based loss	Why CE = KL + entropy?
Sat	Backprop Deep Dive	Manual Conv layer backward	Hand-derive CNN gradients
Sun	Parameter Counting & Complexity	Compute FLOPs & params for ResNet18 & ViT	Model complexity calculation

Week 10 – Interview Prep & Full Projects

Day	Focus	Hands-On / Mini-Project	Interview Qs
Mon	Architecture Design	Design CNN for 5-class CIFAR subset; Mini-project: train & evaluate	Explain design choice

Day	Focus	Hands-On / Mini-Project	Interview Qs
Tue	Architecture Design	Implement Transformer for text classification (IMDB); Mini-project: train & evaluate	Encoder vs decoder architecture
Wed	Paper / Project Explanation	Prepare 3–4 mini-reports (ResNet, YOLO, GAN, ViT)	Explain forward pass, parameters, training tricks
Thu	Flashcards / Quick Revision	Implement small networks (MLP/CNN/ RNN) for 1 batch	Key formulas, layer outputs
Fri	Whiteboard Coding	Forward + backward for small CNN/MLP without autograd	Whiteboard coding Q
Sat	Full Mock Interview	Simulate 3–4 hr interview (all topics)	All-topic coverage
Sun	Full Mock Interview + Feedback	Repeat weak areas: Transformer coding, GAN forward/backward	All-topic coverage