

**Syllabus for Management Trainee (Optics)**

100 Questions from Subject/Discipline

S.No.	Subject
1	Modern Optics
2	Laser Physics and Systems
3	Opto Electronics
4	Optical System Design
5	Optical Materials, Production and Testing
6	Fiber Optic Communication
7	Optical Instrumentation
8	Laser Technology
9	Non Linear Optics
10	Nano Photonics
11	Optoelectronics sensing and MOEMS
12	Integrated Optics
13	Infrared Optics and thermal imaging
14	BioPhotonics
15	Laser Systems and Applications
16	Fourier Optics and Holography
17	Industrial Photonics
18	Advanced Laser Systems
19	Laser Spectroscopy
20	Optical Sources, Detectors and Photometry

**1. Modern Optics:**

Wave Optics - EM Waves - Interferometers - Coherence - Theory of Diffraction - Ray optics - Ray matrices- Polarization - Jones vectors - crystal optics - Gaussian beams - Electromagnetic Optics - Elements of Fourier optics.

**2. Laser Physics and Systems:**

Stimulated emission - Einstein's coefficients- gain medium - Line broadening- threshold condition- population inversion - pumping mechanism - Cavity modes - Resonator stability - Q switching - mode locking - Basic laser systems - Solid state lasers.

### **3. OptoElectronics:**

Optical circular waveguides and their modes of propagation. Optical fiber structures, materials, fabrication, and cables. Signal degradation and design optimization of SM fibers. Semiconductor light sources and detectors for Optical communications. Light modulators and display devices.

### **4. Optical System Design**

Introduction to Optical systems, Ray tracing procedures, Aberrations, Multi lens systems, Photometry of optical systems, Mirrors and prisms, Image evaluation, Optical systems, Optimization techniques.

### **5. Optical Materials Production and Testing**

Types of Optical glass - IR materials - gallium arsenide - Optical glass making, IR materials manufacturing - abrasives, polishing compounds - Tools and fixtures - spherical and plano tools - Optical fabrication -Optical shop testing.

### **6. Fiber Optic Communication**

Elements of optical fiber link, advantages and applications. power launching, joints, splices, connectors, and test methods. Optical receiver and transmission systems - power and rise time budget, noise effects. WDM concepts and components, Optical amplifiers, Optical networks-SONET/SDH, Nonlinear effects, Solitons, Ultrahigh Capacity Networks.

### **7. Optical Instrumentation:**

Radiometry: basic concepts; Visual Systems: magnifiers and eyepieces; Projection Systems: profile projectors; IR and Medical Systems: thermal imaging instruments; Metrology Instruments: interferometric instruments, online optical sensing of temperature and flow.

### **8. Laser Technology**

Power source for CW and pulsed lasers: Energy transfer in solid state laser systems, ion laser systems, molecular lasers, organic dyes and liquid dye lasers. Semiconductor lasers, Excimer lasers and metal vapour lasers, Optics for lasers, damage in optical components.

### **9. NonLinear Optics**

Nonlinear Optical Interactions - Polarization response of materials to light - Harmonic generation- Phase matching - bistability - self focusing - Third-Order Nonlinear Susceptibility- Self-Phase Modulation- Optical Solitons - Four-Wave Mixing - Kerr effect - Multiphoton processes- Stimulated Brillouin and Raman scattering.

### **10. Nano Photonics**

Evanescence fields-propagation and focusing of optical fields - spatial resolution and position accuracy - light generation by nanostructures - Quantum emitters - Nanolasers - Photonic crystals - surface plasmas.

### **11. Optoelectronic Sensing and MOEMS**

Optoelectronic sensors - classification; Materials interactions for sensing; Components and optical fibers for sensing; Optoelectronic systems for sensing Displacement, Temperature, Pressure, Flow, Level, etc., and distributive sensing. FBGs and LPGs for Smart structures. MOEMS for sensing applications.

## **12. Integrated Optics**

Optical waveguides: modes, losses - Planar waveguides, Channel waveguides, Bent and curved waveguides, Branching waveguides-Waveguide excitation- Simulation and Measurements techniques - Waveguide couplers and Gratings - Materials - Electro-optics - Acousto-optics - Fabrication technology - Applications.

## **13. Infrared Optics and Thermal Imaging:**

Unique features of the infrared region - materials, effect of temp on optical properties and athermalization methods, Optical design and material selection, tolerances, Reflective and transmissive infrared zoom systems, Thermal imaging instruments, Night vision equipment. Applications in industry and defence.

## **14. BioPhotonics**

Light Sources, Delivery systems and Spectroscopy: Basics of Biology: Tissue structure - Features of living tissues from the point of optics.- Fundamentals of light-matter interactions. Bioimaging, Biosensors, Tissue engineering, Flow cytometry.

## **15. Laser Systems and Applications:**

Material processing and testing, optical radar, Raman backscattering, absorption, pollution control, alignment surveying and tooling, range finding-rotation rate and velocity measurement, surface inspection, displays, information storage, optical computing, speckle interferometry, ophthalmology, surgery and diagnosis, dentistry.

## **16. Fourier Optics and Holography:**

Frequency response technique for image formation in coherent and incoherent light, Theory of partial coherence - statistical optics, Optical imaging systems and their analysis, Spatial filtering and optical information processing, holography, statistical properties of laser speckle patterns, speckle reduction.

## **17. Industrial Photonics**

Photonics Technology, Active Components, modulation and demodulation; Optical Networks, Control and Management, Reliability Concepts.

## **18. Advanced Laser Systems:**

Gas Lasers, Molecular gas lasers, Ion Laser, Solid state Lasers, Semiconductor lasers, Dye laser.

## **19. Laser Spectroscopy**

## **20. Optical Sources, Detectors and Photometry**