PHY2C02:OPTICS LASER AND ELECTRONICS

A Part

1. State superposition theorem of waves
2. Write down the expression for the resultant intensity of two waves and explain the symbols.
3. State and explain superposition principle.
4. What are coherent sources?How are they realised in practice?
5. Explain the phenomenon of interference. Why a thick film cannot produce interference when illuminated with white light?
6. What are the conditions of constructive and destructive interferences?
7. Draw the diagram of Fresnels two mirror arrangement.
8. Explain the phenomenon of colours of thin films.
9. What is meant by optical path?
10. Explain the interference of light by a plane film.
11. Why Newtons rings are circular?
12. What are Newtons rings? Give its uses.
13. Why two independent sources of light cannot produce an interference patter?
14. Explain why the centre of Newtons rings is dark for reflected light.
15. What are the conditions for sustained interference pattern?
16. Name the two classifications of diffraction.
17. What should be the order of the size of obstacle for diffraction of light?
18. If we look at the sun through a piece of fine cloth, we observe coloured spectrum at the side of hole in the cloth. Why?
19. Draw the intensity distribution curve in Fraunhofer single slit diffraction pattern.
20. What is meant by diffraction of light?
21. Write down the expression for intensity distribution in the diffraction pattern of a single slit and explain the symbols.
22. Write down the grating equation in terms of grating elements
23. Explain the intensity distribution in the diffraction pattern of a single slit.
24. What is Rayleigh criterion for resolution?
25. What is resolving power of a grating?
26. What is a grating?
27. What is meant by plane transmission grating? State the grating law.
28. Define resolving power and dispersive power of grating.

29. What is polarising angle?
30. State Brewster's law.
31. Compare e-ray and o-ray
32. What is meant by negative and positive crystal.
33. Define the term Birefringence
34. What is double refraction?
35. What is meant by double refraction.
36. Differentiate between uniaxial crystals and biaxial crystal. Give one example each
37. How do we produce plane polarised light?
38. Differentiate between plane of vibration and plane of polarization
39. What is a quarter and half wave plate?
40. Write any two applications of polarised light
41. What is a elliptically polarised light?
42. What is linearly plane polarised light?
43. What is a polaroid?
44. Define specific rotation.
45. Define optical activity.
46. Write down the expression for r.m.s. current in a half wave rectifier
47. Explain the functions of half wave rectifier.
48. What is meant by peak inverse voltage?
49. What is the ripple factor of a half wave rectifier?
50. Define the term rectification
51. What is a half wave rectifier?
52. What is meant by the term ripple factor?
53. Write down the expression for efficiency and ripple factor of a full wave and bridge rectifier.
54. Draw the diagram of a centre tapped full wave rectifier
55. Write any two advantages of full wave rectifiers over the half wave rectifier?
56. What is the ripple factor of a full wave rectifier?
57. Write down the expression for r.m.s current in a full wave rectifier
58. What is the basic difference between a centre tapped and bridge rectifier
59. Draw the diagram of a full wave rectifier?

60. Explain the action of a capacitor filter
61. Explain the action of an inductor filter
62. What are filter circuits?
63. Draw the reverse characteristics of a zener diode
64. What is meant by zener breakdown
65. Explain briefly Zener diode as a voltage stabiliser.
66. Draw the I-V characteristics of Zener diode.
67. What are the three regions of a transistor?
68. Draw the output characteristics of a CE transistor
69. What are the three transistor configurations?
70. Draw the practical circuit of a CE transistor amplifier.
71. What is the need for emitter capacitor in a transistor anplifier?
72. Why is the collector region of a transistor made large?
73. Explain the current amplification factor of a transistor
74. Explain the input characteristics of CE configuration.
75. Draw the input characteristics of a CE transistor
76. What is meant by bandwidth of an amplifier?
77. Obtain a relation between alpha and beta and gamma.
78. Define the three current amplification factors.
79. What is the basic function of an amplifier?
80. What is freuency response curve of an amplifier?
81. What is meant by feedback fraction?
82. Write down the expression for the voltage gain of negative feedback amplifier.
83. What is meant by negative feedback?
84. Draw the block diagram of a feedback amplifier.
85. What is an oscillator? Classify them.
86. What is Barkhausen criterion?
87. What is the basic principle of an oscillator?
88. Draw the truth tables of OR and AND Gate.
89. Explain NOR gate
90. Construct a NOT gate from NOR gate

91. Construct OR gate from NAND gate
92. Write the truth tables of three BASIC gates
93. Explain NOT gate with its truth table
94. Construct OR gate from NOR gate
95. Mention the Universal gates. Why are they called so?
96. Construct the XOR gate from basic gates
97. Explain NAND gate
98. What are universal gates?
99. Construct AND gate from NAND gate
100. Draw the truth tables of exclusive OR.
101. State the De-Morgan's theorem.
102. What is meant by coherent light?
103. What are the characterestics of a laser light?
104. What is meant by induced absorption?
105. What is a LASER?
106. What is meant by spontaneous emission?
107. What are coherent sources?
108. Mention two properties of laser beam
109. What is meant by metastable state?
110. Draw basic diagram of a laser system
111. Define the term active medium in a laser system
112. Write any two differences between spontaneous emission and stimulated emission
113. What is meant by stimulated emission?
114. Define the optical resonator system in a laser
115. Write down any two properties of a laser
116. What is population inversion?
117. What are the different types of pumping possible in a laser?
118. Write down the basic condition for a laser action?
119. What is a ruby laser?
120. What is the role of helium in He-Neon laser?
121. Draw the energy levels and transitions in a ruby laser.

122. How population inversion is achieved in Ruby laser?

123. Draw the schematic diagram of He-Neon laser

124. Draw a schematic diagram of Ruby laser

125. Write down any two applications of Laser

126. Name the different types of lasers.

B Part

127. Explain the superposition of sinusoidal waves.

128. What are the conditions for brightness and darkness for interference by normal incidence.

129. A soap film has a refractive index of 1.33. Find the maximum thickness for zero reflection when light of wavelength 6000 Angstrom is incident normally

130. A parallel beam of sodium light is incident normally on the plane parallel film of refractive index 1.5. What is the least thickness of the film that will appear bright by reflection

131. Obtain the condition for construtuve and destructive interference

132. What are the necessary conditions for producing sustained interference.

133. Explain the formation of interference pattern in fresnel's double mirror

134. A parallel beam of sodium light of wavelength 5890 A^o strikes a film of oil floating on water. When viewed at angle of 30^o from the normal 8th dark band is seen. Determine the thicknesss of the film. Refractive index = 1.5.

135. Discuss the formation of interference pattern in a thin film

136. Explain the colours of thin film when received in light

137. Explain why Newton's rings are circular in shape

138. Newton's rings are observed in reflected light of wavelength $5x10^{-5}$ cm. The diameter of 10^{th} ring is 0.5 cm. Find the radius of curvature of lens

139. Derive an expression for the intensity distribution in the diffraction pattern of a single slit and draw intensity curve.

140. A grating has 6000 lines over it and sodium light is incident normally on it. Find the separation between two wavlengths that can be just resolved in first order spectrum if one wavelength is 6000 Angstrom. Also find the resolving power in second order.

141. A parallel beam of sodiu light is incident normally on a plane transmission grating having 6×10^5 lines per meter length. The first order spectrum is found to be deviated through an angle of 20.7 degree from the normal. Calculate the wavelength of the light used

142. How many lines per cm are there in a grating which gives an angle of diffraction of 30 degree in the first order of light of wavelength 6×10^{-5} cm.

143. A plane transmission grating which has 5500 lines per cm is used to produce a spectrum of light from a mercury lamp. What will be the angular separation of the two yellow lines of wavelength 5770 A^o and 5791 A^o when viewed in the second order.

144. A parallel beam of monochromatic light is allowed to be incident normally on a plane transmission grating having 5000 lines/cm and the third order spectral line is found to be diffracted through angle 45^o. Calculate the wavelength of light?

145. When sunlight is incident on water at glancing angle of 37^o, the reflected light is found to be completely plane polarised. Determine the refractive index of water and angle of refraction.

146. The critical angle for glass-air interface is 40 degree. Find the polarizing angle

147. Explain double refraction. write a note on positive and negative crystals

148. Explain polarization by double refraction.

149. A monochromatic light of wavelength 6000 Angstrom is incident normally on a diffraction graing containing 6000 lines per cm. Find the angles at which first and second order maxima are observed.

150. How can we detect if a light is circularly/elliptically/un-polarised using wave plates?

151. Caluclate the minimum thickness of a calcite plate that convert a linearly polarized light into an elliptically polarized light. The refractive indices are $\mu_e = 1.485$ and $\mu_0 = 1.656$ at the wavelength 589 nm

152. Distinguish between linearly polarised, circularly polarised and elliptically polarised light

153. Explain with necessary theory, the production of circularly polarised light

154. A quarter wave plate is constructed from quartz crystal whose refractive indeces are 1.553 (e) and 1.544 (o). Calculate the thickness of the plate for a wavelength of 6500 A^o.

155. A doubly refracting crystal has refractive indices 1.553 for the e-ray and 1.544 for the o-ray. Find the thickness of a quarter wave plate made from the crystal for sodium light of wavelength 689 nm

156. What is a quarter wave plate. Explain its construction

157. What is a half wave plate? How is it constructed?

158. Calculate the thickness of a half wave plate of quartz for light of wavelength 5893 nm. For quartz plate $\mu_0 = 1.5442$ and $\mu_e = 1.5533$

159. Calculate the thcikness of a quartz wave plate for light of wavelength 6778 Angstorm for which $\mu_e = 1.5527$ and $\mu_o = 1.5554$

160. A 20 cm long tube containing 50 cm^3 of sugar solution produces an optical rotation of 10^o. Calculate the quantity of sugar contained in the solution. Specific rotation of sugar is 65^o.

161. A half wave rectifier has a transformer of turns ratio 2 : 1. If the rms value of input voltage is 230 V and the load resistance is 330 ohm, find the dc output voltage and efficiency.

162. A half wave rectifier uses a diode of internal resistance 25 ohm. If the applied voltage is V=60 sin wt V and load resistance is 1000 ohm, find the rectification efficiency and output dc voltage

163. A half wave rectifier uses ideal diodes and has a load resistance of 1000 ohm. If the input ac voltage of rms value 230 V is given, find the power dissipated in the load

164. A bridge rectifier has an ac input of 230 V fed into a transformer of turns ration 4:1. Find the rectification efficiency and dc output voltage, if the load resistance is 500 ohm. Assume ideal diodes

165. Derive an expression for the efficiency of a full wave rectifier.

166. Explain the working of a full wave centre tapped rectifier

167. A centre tapped rectifier has an input 12 V transformer. Each diode has a forward resistance of 2 ohm. If the load resistance is 500 ohm, find the dc load current and rectification efficiency

168. Draw the circuit diagram of a bridge rectifier and explain the working.

169. Explain the working of an inductor filter with diagram

170. Explain the working of a capacitor filter with a neat diagram.

171. A zener diode is used in a circuit to supply a regulated voltage of 10 V across the load. If the series resistance is 100 ohm, the input voltage is 15 V and the load current is 12 mA, find the zener current

172. Explain the reverse characteristics of a zener diode. write a note on the zener breakdown

173. For a zener circuit, find the maximum and minimum values of zener current if the input voltage is in the range 90-125 V, $R_S = 1000$ ohm, load resistance is 2000 ohm and zener voltage is 40 V

174. For a zener diode of zener voltage 3.1 V, the input voltage supplied is 6 V. If the zener current is 18 mA and the load current is to be 25 mA, find the value of series resistance required

175. In a Zener circuit, the load current can vary between 10 mA-100 mA. The input voltage is 10 V and the minimum Zener current is to be 8 mA. Find the value of series resistance required to maintain a constant voltage of 6 V across the load

176. Find the output voltage and current through the zener diode if V_{in} = 100 V, R_s = 5000 ohm, V_z= 25 V and load resistance is 10000 ohm

177. Explain the reverse characteristics of a Zener diode with circuit diagram.

178. A zener diode of V_z = 10 V is used as a regulator across a load of 900 ohm. If the load resistance is changed to 1250 ohm without changing the input voltage, find the change in zener current

179. Explain the working of a CE transistor

180. Describe the input and output characterestics of common emitter npn transistors.

181. The emitter base current of a transisor is 1 mA and base current is 250 μA. Find the values of alpha and beta.

182. Derive the relations connecting current amplification factors alpha, beta and gamma.

183. In a CB circuit, the voltage drop across the load resistance of 3000 ohm connected to the collector is 3 V. if alpha is 0.95, find the value of the base current

184. For a transistor of ß =50, collector resistance is 7500 ohm. If the voltage across the collector resistance is 5 V. Find the base current

185. In a CE circuit, the collector voltage supplied is 7 V and the voltage drop across the collector resistor of 750 ohm is 0.5 V. if the value of alpha is 0.96, determine the collector-emitter voltage and base current

186. Explain the voltage gain, frequency response and bandwidth of an amplifier

187. Explain the concept of feedback. Compare negative feedback and positive feedback

188. Construct OR, AND and NOT gate using NAND gate. Write down the truth tables

189. Write the truth table of NOR gate and construct AND gate using it.

190. Write the truth table of a NAND gate and using NAND gates, construct an OR gate.

191. State De Morgan's theorem and prove it using examples.

192. Explain XOR gate and write the truth table

193. Compare induced absorption, spontaneous emission and stimulated emission

194. Explain key differences between spontaneous emission and stimulated emission

195. Explain the different parts of a laser system

196. Write a short note on pumping in Ruby and Helium Neon laser

C Part

197. Derive the conditions for constructive and destructive interference using necessary theory

198. Describe an experiment with theory to determine the wavelength of sodium light using Newtons ring system.

199. Give the theory of plane diffraction grating and how it is used to measure the wavelength of a given monochromatic source

200. What is grating? Deduce the expressions for a) dispersive power b) Resolving power of grating

201. Describe Fraunhofer single slit experiment with the necessary theory.

202. Discuss the necessary theory for the interference in thin films due to reflected light

203. Explain polarization of light by reflection and brewster law. Prove that when the light is incident at angle of polarization, the angle between reflected and refracted ray is 90 degree.

204. What are quarter wave plate and half wave plate? Deduce the thickness for a given wavelength in terms of its refractive indices

205. Explain the theory for the production of plane, circularly and elliptically polarized light.

206. Explain the working of a half wave rectifier using neat diagram and derive the expressions for efficiency and ripple factor

207. Describe a full wave rectifier circuit and derive an expression for efficiency and ripple factor.

208. With neat diagram, Explain the working of a bridge rectifier. What are the advantages of it over a centre tapped rectifier

209. Explain how a zener diode can be used as a voltage stabilizer

210. With neat diagram, describe the characteristics of a CE amplifier

211. Draw the circuit diagram of a CE transistor amplifier. Explain the frequency response curve and bandwidth

212. Explain the different types of logic gates and mention their symbols, truth tables and boolean equations

213. Explain with truth table, symbol and boolean equations , the different logic gates

214. Describe the principle, construction and working of a Ruby laser.

215. What is the basic principle of laser and explain its parts with suitable diagram

216. Explain with proper diagram, the working of a Helium-Neon laser

D Part

E Part