SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: PHYSICS

Code No.: PHY 125-3

Program: AVIATION

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Chairperson

COURSE OUTLINE

PHY 125

AVIATION

COHERENT UNITS OF MEASUREMENT

Reference: Notes, Coherent Units of Measurement, C.R.E. Heath, 1980.

The three presently used coherent unit systems.

Base quantities and base units.

Derived quantities and derived units.

The distinction between mass and weight.

Standard gravitational acceleration.

The conversion of units of measure.

Dimensionless quantities.

Rules for symbols for quantities and units of measure.

The metric prefixes, their symbols and use.

The proper use of coherent units in coherent equations.

The recognition of coherent and non-coherent equations.

TEMPERATURE MEASUREMENT AND CONTROL

Physical properties that change with temperature.

Liquid expansion temperature measuring devices.

Solid expansion temperature measuring devices, esp. the bimetal type and applications as a strip, coil and helix.

Thermocouple as a temperature sensor, plus characteristics, types and applications.

The mercury switch.

Comparison of the thermocouple thermometer to liquid and semi-conductor types.

Thermocouple as used for engine cylinder head temperature sensor.

Thermistor as used for carburetor throat temperature sensor.

Filled system liquid temperature sensor as used for engine oil temperature sensor.

TEMPERATURE AND HEAT

Reference: Notes, "Temperature and Heat" - NHT-2A, REH 7802.

Types of thermometer*

Celsius and Fahrenheit temperature scales and conversions from one to the other.

Nature of internal energy.

A working definition of heat.

Definition of the kilocalorie.

Definition of the Btu.

Heat and Mechanical and Electrical Systems.

The Mechanical Equivalent of Neat.

Radiant energy conversion to heat.

Specific Heat Capacity.

Heats of fusion and vapourization.

Sublimation.

Vapourization curve and critical point.

Fusion curve.

Definition of Triple Point.

WAVE MOTION AND SOUND

Reference: "Wave Motion and Sound", NWM-28, RH8012,

(See Specific Objectives on following pages.)

WAVE MOTION AND SOUND

SPECIFIC OBJECTIVES:

The student should be able to:

1. State that energy can be transferred from one place to another by transfer of matter or by wave motion,

2. State at least two common examples of the transfer of energy by the transfer of matter,

3. State that the energy transferred by transfer of matter is kinetic energy ad can be evaluated by the relation

   E = 1/2 mv^

   and recognize that m is the mass of the body under transfer and that v is its velocity.

4* Calculate the kinetic energy of any body given its mass and velocity-

5. State that the velocity of any disturbance is a stretched string, rope or cable is give by

   m/L

   and recognize that T is the tension, m is the mass, and L is the length o the string, rope or cable.

6. Calculate a value for any of the quantities found in the equation of the previous objective, given the values for the other three quantities.

7. Meet the requirements of objective 6 if the characteristics of the string rope or cable are given in terms of diameter (or radius), length and density rather than in terms of mass and length.

8. Meet the requirements of objective 6 if the velocity is specificed in terms of length and time rather than directly in velocity.

9. State that the velocity of a disturbance in a string, rope or cable is independent of the amplitude of the disturbance.

10. State that a travelling pulse in a string, rope or cable is reflected upside down from a fixed end.

11. state that the upside-down reflection of a travelling disturbance in a string, rope or cable is also known as reflection out of phase or reflection with a 180*^ phase change.

12. State that a travelling disturbance in a string, rope or cable is reflected right side up (no reversal) from a free end,

13. State that reflection without a reversal of a disturbance in a string, rope or cable is also known as reflection in-phase or reflection with 0*^ phase change,

14. Indicate the direction of travel of the particles of a transverse matter wave at any point along the wave, given a sketch of the wave and its direction of travel.

15. Fulfill the requirements of the previous objective for any section of a transverse wave sketched by himself.

16. State that the reason why a travelling wave in a string, rope or cable dies out is because wave energy is lost.

17. State the ways in which energy is lost by a travelling wave in a string, rope or cable.

18. State a definition of displacement as applied to waves.

19. State a definition of amplitude of a wave.

20. Indicate on a sketch of a sinusoidal waveform the displacement of any particle of the wave and the amplitude of the wave.

21. State the principle of superposition.

22. Plot the superposition of any two given waves regardless of their relative wavelengths or shape.

23. State that the principle of superposition is applicable at any and every instant and at any and every point for wave motion in one, two or three dimensions for waves of the same nature in the same medium.

24. State that the interaction of two or more waves of the same kind in the same medium is called interference.

25. State the conditions that lead to costructive interference and to destructive interference.

26. State that the simplest kind of vibratory motion is simple harmonic motion.

27. State an example of simple harmonic motion based upon uniform circular motion.

28. State that the individual particles of any sinusoidal matter wave are undergoing simple harmonic motion.

29. Recognize the abbreviation S.H.M. to mean simple harmonic motion.

30. State that the relationship between velocity, frequency and wavelength for all kinds of wave motion is v = f.

31. Calculate any wave velocity, frequency or wavelength given the other two

32. State that period is the inverse of frequency, both in words and symbolically as

T = j^
1

33. Calculate any frequency or period given the other.

34. Meet the requirements of objective 31 if frequency is replaced by a period.

35. State a definition of a <u>periodic disturbance</u>.

36. State a definition of a transverse wave and give two examples of a trans verse wave.

37. State a definition of a longitudinal wave and give two examples of a longitudinal wave.

38. State an example of a kind of wave motion which is both transverse and longitudinal.

39. State that wave motion involves no net transfer of matter.

40. State the mechanism of sound as a wave motion.

41. Write an explanation of the way in which a loudspeaker produces a sound wave.

42. State the material factor that primarily determines the speed of sound in a particular medium.

43. State that the frequency of a sound wave depends solely on the source of that sound and not on any characteristics of any media through which the sound subsequently travels.

44. State that only velocity and wavelength of a wave change as the medium through which the wave moves changes.

45. Calculate either the wavelength or velocity of a wave in a changed medium, given one of them along with both velocity and wavelength in a previous medium.

46. Fulfill the requirements of objectives 31 if distance and time are given rather than velocity, namely to claculate a value for time, distance, frequency or wavelength given values for the other three.

47. State that an aural phenomenon called beats occurs when two sounds of different frequencies are heard simultaneously.

48. State that the beat frequencies that occur as the result of hearing two different frequencies simultaneously are the half sum and the difference of those two different frequencies, and know that the difference frequency is usually easily heard at frequencies up to 20 or 30 Hz.

49. State that the beat phenomenon is a direct consequence of the principle of superposition.

50. Recognize that the commonly used pictorial representation of a sound wave as a "transverse wave" is only a convenience and that the pictorial representation is actually a graphical plot of pressure (or displacement) against distance {or time).

51. Determine the frequency of a sound source if given the beat frequencies produced by it in combination with two other sound sources of given frequency.

52. Explain the circumstances required of a sound source and/or a listener to produce the doppler effect.

53. State that the speed of sound in any medium is independent of the motion of any sound source or listener.

54. State that the speed of sound in any medium depends only upon the characteristics of the conducting medium itself.

55. Write the relationship $f_{IJ} = f_S \dfrac{V + V}{V - V3}$

Recognize that it is the relationship among sound velocities and frequencies pertaining to the doppler effect and also recognize that V is the velocity of sound in the medium of travel

v_ is the velocity of the source

V_S is the velocity of the listener

f is the sound frequency of a sound source and

f_{i-i} is the sound frequency perceived by a listener

56. Apply the relationship of the previous objective to calculate a value for any one of the quantities, given values for the remaining quantities.

57. Explain in writing the nature of the circumstances that give rise to the doppler effect in terms of sound source and/or listener velocities, sound speed, sound frequencies and sound wavelengths.

58. State that the doppler effect occurs not only with sound waves but also with all other kinds of waves, and in particular with electromagnetic waves.

59. State a common example of the doppler effect with electromagnetic waves.

60. State the velocity of electromagnetic waves in free space, with the value in SI units.

61. State that light and radio waves of all kinds are all forms of electromagnetic waves.

62. Define <u>linear relationship</u>.

63. Define <u>intensity</u>.

64. Write the relationship

$$I = \frac{P}{4\, r^{2}}$$

and recognize that it is the relationship that gives the intensity at a distance r from an omnidirectional energy source of power R.

65. Apply the relationship of the previous objective to calculate a value for distance, power or intensity, given values for the other two.

66. Fulfill the requirements of the previous objective if the power is not stated explicitly but given as values of energy and time, given values for the remaining variables.

67. Define <u>omnidirectional power source</u> or <u>omnidirectional energy source</u>.

68. Recognize that isotropic energy source and omnidirectional energy source mean the same thing.

69. State the value of sound intensity that is used as a sound reference intensity.

70. State that db is an abbreviation for decibel.

71. State **that the** human ear does not respond linearly to changes in sound intensity, but that the response is approximately logarithimic.

72. Write the relationship

sound level in db = 10 log   I^

and recognize that I is the sound intensity under consideration and I the reference sound intensity.

73. Apply the relationship of the previous objective to determine any sound level in db given the intensity I.

74. State that prolonged exposure to sound levels in excess of 85 db usuall leads to permanent hearing damage.

75. State that the extent of damage to human hearing due to excessive sound levels dep'ends upon the time of exposure and in particular, that the greater the level, the shorter is the exposure time required to cause damage.

76. State the susceptibility to damage to hearing due to excessive sound levels varies from individual to individual.

77. Recognize the need to look up any value, in a table or in text material supplied, that is required in a problem and that is needed in the solution of the problem but not explicitly given.

i

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73. Apply the relationship of the previous objective to determine any sound level in db given the intensity I.

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