KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Marks Scored:

Level: B.Arch.
Year : I

Course : ARCH 101
Semester: I

Exam Roll No. :

Time: 30 mins.

F.M. : 20

Registration No.:

Date 02 JUN 2019

SECTION "A"
[20Q. × 1 = 20 marks]

Choose the most appropriate answer among the given options and ***encircle*** *the letter of your choice. The symbols, unless mentioned otherwise, have their usual meanings.*

1. A body executes simple harmonic motion. The potential energy (P.E.), the kinetic energy (K.E.) and total energy (T.E.) are measured as function of displacement x. Which of the following statement is TRUE?
   [a] K.E. is maximum, when x = 0. [b] K.E. is maximum, when x is maximum.
   [c] T.E. is zero, when x = 0. [d] P.E. is maximum, when x = 0.

2. A plane wave propagating along the *x*-axis has the form
   $$y(x,t) = (0.002\ cm)\sin\left(\frac{2720\pi}{s}t - \frac{8\pi}{m}x\right).$$
   The wavelength is
   [a] 0.0398 m. [b] 0.125 m. [c] 4.00 m. [d] 0.250 m.

3. The superposition of two waves $y_1 = a\sin\omega t$ and $y_2 = a\sin(\omega t + \delta)$ arriving at the same point in space at the same time is
   [a] $y = 2a\ \sin\omega t\ \cos\left(\frac{\delta}{2}\right)$ [b] $y = 2a\ \sin(\omega t + \delta)\ \cos\left(\frac{\delta}{2}\right)$
   [c] $y = 2a\ \sin\left(\omega t + \frac{\delta}{2}\right)\ \cos\left(\frac{\delta}{2}\right)$ [d] $y = 2a\ \cos\left(\omega t + \frac{\delta}{2}\right)\ \cos\left(\frac{\delta}{2}\right)$

4. A helium–neon laser (λ = 632.8 nm) is used to calibrate a diffraction grating. If the first-order maximum occurs at 20.5°, then, spacing between adjacent grooves in the grating is
   [a] $1.81\times10^{-9}\,m$ [b] $1.81\times10^{-6}\,m$ [c] $1.81\times10^{-10}\,m$ [d] $1.81\times10^{-8}\,m$

5. The emission of electromagnetic radiation in the form of photons of a given frequency, triggered by photons of the same frequency is called
   [a] X-rays emission. [b] Spontaneous emission.
   [c] Stimulated emission. [d] Excitation emission.

6. The unit of thermal conductivity in SI is
   [a] cal s^{-1} cm^{-1} K [b] J s m^{-1} K^{-1} [c] W m^{-1} K [d] W m^{-1} K^{-1}

7. Your temperature is 37°C. Assuming your skin is a perfect radiator $(\varepsilon = 1)$, determine the wavelength corresponding to the largest intensity (in μm).
   [a] 8.0 [b] 9.3 [c] 5.7 [d] 3.0

8. Visual comfort within a space is not achieved if there is
[a] Adequate illuminance level. [b] Harmonious luminance distribution.
[c] Direct glare. [d] Good color rendering.

9. Amount of daylight depends on
[a] Time of the day. [b] Longitude.
[c] Rotation of the earth. [d] Vegetation.

10. Which of the following is a daylight component
[a] Extremely Reflected light. [b] Directed Light.
[c]Intentionally Reflected Light. [d] Externally Reflected Light.

11. Which of the following does not affects the utilization factor of the artificial light?
[a] Light output ratio of luminaries. [b] Room proportions.
[c] Size of the Opening. [d] Room reflectance.

12. Reverberation time of a room does not depend on
[a] Volume of the room. [b] Effective Area of the room
[c] Length and Breadth Ratio [d] Surface type of the room

13. Which of the following construction technique effectively insulate impact sound?
[a] Floating Floor. [b] Vibration Isolators
[c] False Ceiling. [d] Sealing acoustics leaks

14. Thermal performance of a material is better if,
[a] U-Value is Lower [b] Thermal Resistivity if Lower
[c] Thermal Conductivity is higher [d] K-Value is Higher

15. Which of the following is not the objective of thermal control techniques?
[a] To prevent heat gain [b] To reduce heat loss
[c] Remove excess heat by cooling methods [d] To maintain outdoor temperature

Fill the following blanks with appropriate answers.

16. For ***water,*** the triple point occurs at _____.

17. A wide group of analysis techniques used in science and technology industry to evaluate the properties of a material, component or system without causing damage is _____.

18. When polarized light of intensity I_0 is emitted by a polarizer and then incident on an analyzer and the angle between the polarizer and analyzer transmission axes is θ , the light transmitted through the analyzer has an intensity equal to _____.

19. Schools and Library are planned in a zone with noise level less than _____ dB.

20. Thermal control using Boiler, A/C, heater is _____ control techniques in cold climate.

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02 JUN 2019

Level : B.Arch.
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Time : 2 hrs. 30 mins.

Course : ARCH 101
Semester: I
F.M. : 55

SECTION "B"
[5Q. × 4 = 20 marks]

*Attempt **ALL** questions.*

1. Derive an expression for the wave equation of a stationary wave. Explain the positions of nodes and antinodes.

OR

What is ultrasonic? Give in short the different methods of detection of ultrasonic waves.

2. Monochromatic light from helium-neon laser ($\lambda_1 = 632.8$ nm) is incident on a diffraction grating containing 6000 grooves per centimeter. Find the angle at which the first- and second-order maxima are observed. What if you looked for the third maximum? Would you find it?

3. Define simple harmonic motion. Establish the differential equation of motion for a damped harmonic oscillator. Sketch graphs of position versus time for an underdamped oscillator, a critically damped oscillator, and an overdamped oscillator.

OR

Explain what you mean by (a) Relative humidity, (b) Absolute Humidity, (c) Dew point, (d) Saturated water vapour.

4. What is noise? Explain various techniques of airborne and impact sound insulation with necessary sketches.

5. Why architects prefer daylight over artificial light? Briefly explain daylight techniques adopted in Buildings designed by architect Louis I. Kahn.

OR

Why day lighting is necessary in architecture? Explain building orientation and site planning techniques for day light

SECTION "C"
[5Q. × 7 = 35 marks]

*Attempt **ALL** questions.*

6. What are coherent sources? Prove that the distance β between two successive bright fringes formed in Young's double slit experiment is given by

$$\boxed{\beta = \frac{D\lambda}{d}}.$$

Why doesn't the light from the two headlights of a distant car produce an interference pattern?

OR

Write short notes on: (i) Brewster's Law, (ii) Double refraction, and (iii) Specific Rotation.

7. (a) Describe the radial flow of heat through a spherical shell.
(b) The surface of the sun has a temperature of approximately 5800 K. To a good approximation, we may treat it as a black body. (a) What is the peak-intensity wavelength λ_m ? (b) What is the total radiated power per unit area?

8. Dimension of a lecture room is 9m x 6m x 3.2m (length x breadth x height). The room has two windows of size 2.5m x 1.5m (Width x Height) and two doors (1.2m x 2.1m- Width x Height). The walls and ceiling are plastered and the floor has glazed tile finish.
Absorption Coefficient (α) values for 500 Hz are as follows:

Glazed Tile Finish: 0.015
Glass (Window): 0.18
Chalkboard: 0.01
Plaster on brick: 0.02
Wooden Door: 0.09

(a) Find the reverberation time of the room.
(b) Recommended reverberation time for classroom is 0.4 to 0.6 seconds. It is decided to change wall finish by acoustic panel for the above room to achieve the recommended reverberation time. What area of acoustic panel is required if the reverberation time of the room is to be maintained at 0.5 sec. The absorption coefficient of the panel is 0.65.

9. A room 5m x 4m is lit by 2 Fluorescent Lamps (40 Watt, 60 lm/W efficacy) and 2 incandescent lamp (100 watt, 15 lm/W efficacy). Assume utilization factor of 0.5 and maintenance factor of 0.8. What is the illumination level achieved in the room? If it is necessary to illuminate the room to 200 lux, how many additional lamps (fluorescent/ incandescent) is needed?

OR

What are various systems of lightening and their symbols? Explain various artificial lighting system with necessary sketches.

10. What are various thermal control techniques of buildings in a Cold Climate? Explain few passive systems of thermal control with necessary sketches.

OR

Why air cavity is preferred in wall? What is the significance of U-Value? Find the U- value of the given composite wall.

- 114mm engineering brick work $(k) = 1.150\ W/m\ deg\ C$
- 50mm cavity $(Rc) = 0.176\ m^2 deg\ C$
- 100mm dense concrete blocks $(k) = 1.440\ W/m\ deg\ C$
- 25mm wood wool slab $(k) = 0.093\ W/m\ deg\ C$
- 12mm plaster $(k) = 0.461\ W/m\ deg\ C$
- Surface resistance

$$\frac{1}{f_0} = 0.076\ m^2 deg\ C$$

$$\frac{1}{f_i} = 0.123\ m^2 deg\ C$$