KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Marks Scored:

Level : B. Sc.
Year : IV

Course : PHYS 401
Semester : I

Exam Roll No. :

Time : 30 mins.

F. M. : 20

Registration No. :

Date : MAR 2 4 2017

SECTION "A"

[20 Q. × 1 = 20 marks]

1. The induced e.m.f in the armature conductors of a d.c motor is
   a. Sinusoidal b. Trapezoidal c. Rectangular d. Alternating

2. A d.c motor can be looked upon as d.c generator with the power flow
   a. Reduced b. Reversed c. Increased d. Modified

3. The frequency of voltage generated by an alternator having 4 poles and rotating at 1800 r.p.m is……hertz.
   a. 60 b. 7200 c. 120 d. 450

4. Which one of the following machine when run on no load can be used for power factor correction?
   a. Induction motor
   b. Synchronous motor
   c. D.C motor
   d. None of the above

5. When the rotor of induction motor is blocked, the frequency of the supply voltage is
   a. Zero
   b. Greater than the supply frequency
   c. Less than the supply frequency
   d. Equal to the supply frequency

6. The average output voltage of a step down dc-dc converter is
   a. $V_{in} * (T/T_{on})$ b. $V_{in} * (T_{off}/T)$ c. V_{in} d. $V_{in} * (T_{on}/T)$

7. A single phase full wave controlled rectifier with gate pulse to thyristors given, conduction of thyristors begins at
   a. $\omega t = \alpha$ only
   b. $\omega t = \alpha$ and $\omega t = \pi+\alpha$
   c. $\omega t = \alpha$ and $\omega t = 2\pi+\alpha$
   d. $\omega t = \alpha$ and $\omega t = 2\pi-\alpha$

8. If the transmission voltage is doubled, the power transfer capability of the system
   a. Becomes four times and the line losses are also relatively reduced
   b. Is the same but the line losses are only reduced
   c. Becomes twice and the line losses are also relatively reduced
   d. Becomes twice and the line losses are zero

9. Electrical breakdown is a long reduction in the resistance of an electrical insulator when the voltage applied across it
   a. Exceeds the breakdown voltage
   b. equals the breakdown voltage
   c. Exceeds both the breakdown voltage and current
   d. All of the above

10. The liquid dielectric is used in a transformer for
    a. Providing the insulation between the live parts of transformer
    b. Providing the insulation between the ground parts of transformer
    c. Carrying out the heat from the transformer to atmosphere providing cooling effect
    d. All of the above

11. The number of modes for a graded index fiber having core diameter 62.5 micrometer, (with NA : 0.275, operating wavelength :1300 nm) is given by
a. 39 b. 40 c. 41 d. 42

12. Type of light used in optical fiber communication is
a. Ultraviolet b. Green c. Red d. Infra red

13. Suppose a laser diode radiates red light with $\lambda = 650$ nm. What is the energy of single photon in this light?
a. 4.5 eV b. 3.5 eV c. 2.9 eV d. 1.9 eV

14. In *physical vapor* thin film deposition technique (in particular, sputtering), one of following steps is mandatory:
a. The inert gas collides with sputtering target and releases the sputtered target atom which deposit on the substrate
b. The precursor solution is directly deposited on the substrate
c. The precursor solution is spin casted on the substrate
d. A vapor of sample is created by heating which deposits on the substrate

15. The major parameters in spray pyrolysis process that causes to deposit good thin films are:
a. Substrate temperature,
b. Precursor concentration and the flow rate of the solution
c. Height between nozzle and substrate
d. All of the above

16. Analytical tool that is useful for structural information (crystallinity, crystallite size) is
a. UV-Vis Spectroscopy b. Scanning Electron Spectroscopy (SEM)
c. EDX d. XRD

17. A XRD spectrum of a ZnO thin film, recorded with X-Ray of wavelength λ, found to have a peak with the full width half maximum (FWHM) B (2θ). What would be appropriate relation for estimating the crystallite size in that film?
a. $B = (B(2\theta)/\text{Cos}\theta).0.94\ \lambda$ b. $B = 0.94\ \lambda / (B(2\theta)*\text{Cos}\theta)$
c. $B = 0.94\ \lambda / \text{Cos}\theta$ d. None of above.

18. Input parameters for well known Swanepoel method of thickness estimation of a thin film are
a. Maxima and minima of a transmittance curve and associated wavelength
b. Transmittance values at the onset and off set of the curve
c. Refractive indices of the analyte and substrate
d. The parameters given in (a) and (c)

19. Cast iron is an alloy of Iron in which major impurities are
a. Carbon b. Silicon and Magnesium
c. Carbon and Silicon d. Potassium and Silicon

20. White caste has less Silicon. As a result, the Carbon and Iron combine together to form
a. Iron-Carbide b. Carbon-Silicon c. Silicon –Magnesium d. None of all

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SECTION "B"

[5Q × 4 = 20 Marks]

1. Define a dc to dc converter and its applications. Explain the working principle of any one type of dc to dc converter. [1.5+2.5=4]

2. Sketch the gate pulse I_g, output voltage V_o and output current I_o waveform for a single phase full wave controlled rectifier with resistive load, with 30^0 degree firing angle.

3. What is an electrical breakdown? Explain the breakdown in solid dielectric due to treeing. [1+3=4]

4. How does light travel in an optical fiber? Establish relationship between numerical aperture (NA), acceptance angle and refractive indices with suitable figures.

5. Describe the process and information one can extract from X-Ray diffraction crystallography. How would you derive the crystallite size with the help of measured XRD spectrum [Hint: Scherer's formula]

SECTION "C"

[5Q × 7 = 35 marks]

6. Explain the working principle of a three phase induction motor.
   a. A 230 V, 10 hp, four pole, 60 Hz, Y-connected induction motor has a full-load slip of 3 percent
      i. What is the rotor speed of this motor? [2]
      ii. What is the shaft torque of this motor at rated load? [2]
   b. A 230 V dc shunt motor runs at 1000 r.p.m on full load, drawing a current of 10 A, the field resistance is 230 Ω and the armature resistance is 0.5 Ω. Calculate the resistance to be inserted in series with the armature so that the speed at full load is 950 r.p.m. [3]

7. Explain the three conditions possible due to Townsend breakdown criterion. A load of 450 kVA operates at a power factor of 0.65 lagging. An additional synchronous motor is added having an input power of 90 kW and a maximum power factor of 0.85 leading, determine reactive power and the overall power factor.

8. a. What is modal dispersion and how does it occur? What are the possible solutions for modal dispersion in optical fiber communication? Specify and explain. [5]
   b. What are the practical applications of nano-material based thin solid films? [2]

9. a. Write stepwise methods for chemical vapor deposition and spray pyrolysis process with figure. [4]
   b. Distinguish between the following:
      i. Single crystalline, polycrystalline and amorphous materials.
      ii. Images observed with SEM and AFM. [3]

10. a. How can you derive a band gap of a thin film from the measured transmittance curve? Explain with necessary equation and well labeled diagram. [3]
    b. What are the properties of cast iron ? Give the scheme of producing various forms of iron-carbon at equilibrium. Show the phase-transformation in Fe - C alloys [4]