B.Sc.III (Semester VI)
Subject: PHYSICS
DSC F4 Paper – XVI Energy Studies and Materials Science
Question Bank

UNIT-I 1.Energy and Wind Energy

1. ------------ is worthless   energy not useful for doing work.
    a) Exergy   b) power
    c) Anergy   d) work done

2.From physics point of view, energy is nothing but ----------
    a) **capacity to do work**   b) energy to work
    c) power to do work   d)force to do the work

3.------------ is that part of energy which gives useful work.
    a) **Exergy**   b)Energy
    b) Anergy   d)worthless

4. From the law of -------- of energy states that energy can neither be created nor be destroyed.
    a) utilization   **b) conservation**
    b) consumption   d) production

5. Since long Back in history **--------------** is found to be used for propelling ships age.
    a)solar energy   b)ocean energy   **c)wind energy**   d)biomass energy

6. Wind is nothing but   ------------
    a) Any mass in motion   **b) air mass in motion**
    c) air in motion   d) kinetic energy of air

7. Wind energy is manifestation of ----------
    a)Biomass energy   b) ocean energy
    c) solar energy   d)biofuel energy

8. Origin of wind energy lies in -------
   a)Biomass energy   b) ocean energy
   c) solar energy   d)biofuel energy

9. First wind turbine was constructed and installed in 1985 in ------------
    a) **Denmark**   b)Canada
    c)Netherland   d)Sweden

10. The winds resulting due to unequal heating and cooling of ground surface and water surface during the day and night is called -----------
    a) planetary winds   **b)local winds**
    c)normal winds   d) polar winds

11. The most suitable wind speed for wind turbine generator unit is ------
  a) 5 m/s   **b) 10 m/s**   c) 25 m/s   d) 2 m/s

12. The winds caused due to unequal temperatures at polar regions and equatorial regions is called-------------

a) planetary winds   b)local winds

c)normal winds   d) polar winds

13. Area under Po-H curve represents ---------------- of wind turbine in 24 hours.

  a) Incident energy   b) **energy output**

  c) total energy   d) wasted energy

14. Which of the following is VAWT?

 a) space frame rotor design   b) wind mill type design

 c) bicycle wheel design   d) **Darrius wind turbine**

15. Which of the following is not HAWT?

 a) space frame rotor design   b) wind mill type design

 c) bicycle wheel design   d) **Darrius wind turbine**

16. Maximum power from wind turbine for given incoming wind velocity v_i is ------

  a) $P_{max} = \dfrac{8}{27}\rho A\, v_i^3$ a) $P_{max} = \dfrac{27}{8}\rho A\, v_i^3$

  c) $P_{max} = \rho A\, v_i^3$ d) $P_{max} = \dfrac{8}{27}\rho Av$

17. If the wind turbine has efficiency of 30% and output power of wind turbine is 300 watt then power of incident wind is --------- watt.

  a) 10   b) 100   **c) 1000**   d) 10000

18. Which of the following is S.I. unit of wind power density?

 a) W/cm^2 b) KW/cm^2 **c) W/m^2** d) KW/m^2

19. For incoming wind with velocity 'v' , Maximum power obtained from wind turbine is proportional to ------------

  a) v   b) v^2 c) v^3 d) 2.v

20. If A the area swept out by blades of wind turbine and Pw is the wind power density then Incident wind power is given by --------

  a) P = Pw.A   b) Pw = P.A

  c) P = Pw.A^2 c) P = Pw.A^3

21. Wind power density P = ------

  a) $\dfrac{F}{A\,S}$ b) $\dfrac{E.A}{S}$

  c) $\dfrac{E.S}{A}$ d) $\dfrac{E.}{A}$

22. ------------- blade HAWT is more stable and gives more power output.

 a) One   b) two   **c) three** d) four

23. The efficiency factor of wind turbine is given by-----------

$a) \eta = PoXPi$ $\qquad\qquad$ $b) \eta = \dfrac{Po}{Pi}$

$c) \eta = \dfrac{Pi}{Po}$ $\qquad\qquad$ $d) \eta = Po - Pi$

24. Wind farm is ---------------
   a) farm where wind flows heavily
   b) used for agricultural work
   c) grinding mills operate on wind power
   d) number of wind turbine generator units are installed in large area

25. For VAWT, the rotating shaft axis is ....

 (a) Vertical $\qquad$ (b) tilted $\qquad$ (c) horizontal $\quad$ (d) inclined at 45° with the vertical

26. India's potential for electrical power from wind power is ....

 (a) negligible $\qquad$ (b) 50 MW $\qquad$ **(c) 20000 MW** $\qquad$ d)100KW

27. If Va and Vb, are respectively the wind velocities at the inlet and exit sides of
 horizontal axis type wind-turbine then -------.

a) Va > Vb (b) Va < Vb c) Va = Vb d) Va>0,Vb>0

28. If P_a, and P_b, are respectively the wind pressures at the inlet and exit sides of a
horizontal axis type wind-turbine....

a) Pa > Pb (b) Pa < Pb c) Pa = Pb d) Pa>0,Pb>0

29. For HAWT, the rotating shaft axis is ------------

 (a) Vertical (b) tilted **(c) horizontal** (d) inclined at 45° with the vertical

30.Wind energy is firstly converted into ------- energy and then into electrical energy.

   a) kinetic $\qquad$ **b) mechanical** $\quad$ c) potential $\qquad$ d)pressure

31. Electrical energy obtained from single wind turbine is not sufficient so ------ have to
   be used
   a) Solar panel **b)wind farms** c)biomass energy d)ocean energy

32.------------ are used for water pumping, grinding grain mills.
   a) Wind turbine generators $\quad$ **b) wind mills**
    c) mechanical rotors $\qquad\qquad$ d) biomass energy resources

33. The tips of wind turbine are provide with --------
   a)yaw control **b) pitch control** c) speed control d) gear control system

34. To adjust the plane of blades normal to incoming wind ---------- is used

  a)yaw control b) pitch control c) speed control d) gear control system

35. Primary energy is also called as --------------energy-
   a) Clean $\qquad\qquad$ **b) raw**
   a) intermediate $\qquad$ d) useful

Q.2 Long answer questions for 8 Mark

 i. Explain wind power density. Obtain expression for efficiency factor of wind.

 ii. Show that power of wind turbine proportional to cube of wind velocity.

Q.3. Long answer questions for 4 Mark

 1. Explain wind energy quantum.

 2. Explain With neat diagram horizontal axis propeller type wind turbine generator unit.

 3. Explain the classification of energy sources.

 4. Comment on energy demands in future.

 5. Define and explain the wind energy density.

> **Unit I : 2. Solar energy**

1. Solar cell converts solar energy into -------- energy.
  a) Chemical b) mechanical
  c) Electrical d) thermal

2. Which of the following is not renewable source of energy?
  a) wind b) solar
  c) nuclear d) ocean

4. The value of solar constant is -----------
  a) **1367 W/m^2**   b) 1357 W/m2
  b) c) 1347 W/m2   d) 1377 W/m^2

5. In satellite station solar energy plant, the solar energy from satellite is send to the ground station in the form of --------
  a) IR waves   b) heat waves
  c) microwaves   d) light waves

6. Total solar radiation (energy) received on a flat horizontal surface on the earth is called—
  a) Solar constant   **b) solar insolation**
  c) clarity index   d) solar density

7. Solar constant is measured ----------------
  a) on earth surface   b) at sea level
  c) outside the earth's atmosphere d) in earth's atmosphere

8. There are *n* solar cells in a module and *m* modules in a panel. If P is the power of single solar cell, then power of the solar panel is --------
  a) ***n* x *m* x P**   b) *n* + *m* + P
  b) c) (*n* x *m*) / P   d) P / (*n* x *m*)

9. ----------- resource has largest contribution in electrical production.
  a) Coal   b) Oil

c) Nuclear   d) solar

10. Maximum power of solar cell is --------
    a) $I_{sc} \times V_{oc}$ b) $I_{sc} \times V_m$
    c) $I_m \times V_{oc}$ **d) $I_m \times V_m$**

11. The value of solar constant is -----------
    c) **1367 W/m^2**   b) 1357 W/m2
    d) c) 1347 W/m2   d) 1377 W/m^2

12. Solar cell converts solar energy into ---------- energy.
    a) Chemical   **b) electrical**
    c) mechanical   d) biological

13. The atmospheric clarity index varies between --------
    a) 0 and 1   b) **0.1 and 0.7**
    c) 1 and 2   d) 0 and infinity

14. The wavelength range for visible region of solar spectrum is ------
    a) 0.76 to 2 µm   **b) 0.4 to 0.76 µm**
    c) 0.2 to 0.39 µm   d) 2.0 to 4 µm

15. A module in a solar panel refers to-----
    a) Series arrangement of solar cells
    b) Parallel arrangement of solar cells.
    c) **Series and parallel arrangement of solar cells**
    d) random arrangement of solar cells

16. The region where the electrons and holes diffused across the p-n junction of solar cell is called ----
    a) Depletion boundary   **b) Depletion region**
    c) Depletion space   d) Depletion junction

17. Solar collector converts solar energy into -------
    a) Electrical energy   b) mechanical energy
    c) thermal energy   d)radiation energy

20. Most of the solar energy available in the -------- region of the solar energy spectrum.
    a) **Visible**   b) ultra-violet
    b) c) infrared   d) microwave

21. Clarity index on clear day at noon is------
    a) 0.1   b) 0
    c) 0.7   d) infinity

22. The I-V characteristics of a solar cell are drawn in the ------- quadrant.
    a) First   b) Second
    c) Third   **d) fourth**

23. The solar energy received per unit area per unit time normal to the direction of the sunrays at mean distance between earth and sun is -------
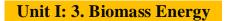   a) **Solar constant**   b) solar insolation

b) c) Clarity index   d) Energy quantum

24. A solar PV panel has 50 cells and 100 modules. If power of each solar cell is 0.2 watt then power of the panel is -------
   a) 100 Watt   **b) 1 K Watt**
   b) c) 25000 Watt   d) 10 watt

25. ---------- in which solar energy is used by thermal route.
   b) Solar cell   b)solar water heater
   c) c) LED   d) solar panel

26. ---------- in which solar energy is used by photovoltaic route.
   a) Solar cell   b)solar water heater
   c) LED   d) solar panel

Q.2 Long answer questions for 8 Mark
i. Explain essential subsystems in solar energy plant.
ii. Explain solar photovoltaic system with neat diagram.

Q.2 Short answer questions for 4vMark
i. Explain solar energy spectrum with neat diagram.
ii. Explain solar constant, clarity index and solar insolation.
iii. Explain in brief the solar energy from satellite station through microwaves to earth station.
iv. State merits of solar PV system.
v. A solar PV panel has 50 modules each containing 100 solar cells. If power of single solar cell 0.5 Watt and load connected across the panel is 1000 ohms then calculate output power of panel and output voltage across load.

Unit I: 3. Biomass Energy

1. .... is the cause of origin of biomass energy.
   (a) **Photosynthesis** (b) fermentation (c) oxidation (d) deoxidation

2. Photosynthesis takes place ....
   (a) only in green plants (b) in any plant (c) even in dry wood (d) in any living organism.

3. Algae is a kind of ....
   (a) tree   **(b) pack of small plants** (c) microorganism (d) chemical

4. Algae in the presence of sunlight and organic waste forms ....
   (a) methane (b) carbon dioxide **(c) biomass** (d) ethanol

5. Biogas is .... gas.
   (a) methane (b) propane (c) butane (d) ethane

6. .... not included in the category of biomass.
   (a) vegetables (b) forest waste (c) agricultural waste **(d) fossil fuels**

7. Which of the following is biochemical conversion process of

biomass conversion ?

(a) pyrolysis (b) incineration **(c) fermentation** (d) ignition

8. Which of the following is not a part of Biogas plant?

(a) digester (b) gas holder **(c) pyrolysis reactor** (d) distribution line

9. A process of decomposition of organic matter by microorganisms

is called as ....

(a) pyrolysis **(b) fermentation** (c) anaerobic digestion (d) incineration

10. What are the products of the anaerobic digestion?

      a) Methane   b)CO_2 C) Traces of H_2S **d)All above**

11. The process of anaerobic digestion is carried in ….

    a)Gasifier   b)**Biogas plant**   **c)**Fermenter   d)None of above

12. Biogas plant essentially consists of …

    a)Digester   b)Gas holder   c)**Both a and b**   **d)**Incinerator

13. Anaerobe is a microorganism which grows in……….

      a. The presence of oxygen

      b. Absence of oxygen

      c. Absence of moisture

      d. Absence of H_2S

14. Fermentation is a process where ……………… is converted in to alcohol using yeast.

      a. Sugar cane

      b. Gobar

      c. Bio-degradable waste

      d. All above

15. Which one of the following is not a biomass resource?

      a. Green plants

      b. Algae

      c. Industry waste

      d. Coal

16. Biomass from cultivated crops includes …

      a. species with fast growth rate

      b. species having high energy density

      c. both aquatic and land based species

      d. All above

17 Ethanol(ethyl alcohol) can be mixed with petrol(gasoline) to produce --------

    a) Diesel   b)kerosene   **c)gasohol**   d) ethagasol

18. ---------is the mother process of in the life cycle and is developed in green plants.

   (a) **Photosynthesi**s (b) fermentation (c) oxidation (d) deoxidation

19. Algae is kept in special tank called -------

a) algae pond   b) biomass pond   c)anaerobe pond   d) water pond

20.Biomass from cultivated crops called --------

a)biomass farm   **b)energy farms**   c)wind farms   d) tree farms

Q.2 Long answer questions for 8 marks

i. What are Biomass and Biomass resources ? state the two important categories of
  biomass resources.

ii. Explain an aerobic digestion and fermentation process of biomass energy
    conversion.

Q.3 Short answer questions for 4 marks

i. Explain algae Biomass

ii. Explain the origin of biomass

iii. Explain biomass energy resources

iv. Explain Biomass conversion processes.

v.   Explain how fuel gas is obtained by simple and aerobic digestion process.

vi. State advantages of an aerobic digestion process.

vii. What is fermentation? Explain ethanol fermentation.

Unit II Superconductivity

i) The temperature at which a normal conductor becomes a superconductor is called
   as.......

(a) Superconducting temperature   (b) curie temperature

(c) particular Temperature   (d) critical temperature

(ii) Critical temperature of mercury is ....

(a) 233 ^{0}K   (b) 4.2 °K   (c)34 °K   (d) 90 °K

iii) The critical magnetic field of a superconductor varies with temperature as —------

a) $Hc = Ho\left[1-\left(\dfrac{T}{Tc}\right)^2\right]$ b) $Hc = Ho\left[1+\left(\dfrac{T}{Tc}\right)^2\right]$

c) $Hc = Ho\left[1-\left(\dfrac{Tc}{T}\right)^2\right]$ d) $Hc = Ho\left[1+\left(\dfrac{Tc}{T}\right)^2\right]$

(iv) Superconductors are ....

(a) perfect ferromagnets   (b) perfect paramagnets

(c) perfect diamagnets   (d) perfect ferrimagnets

(v) The essential properties of superconducting materials are ....

(a) only zero resistivity   (b) only perfect
  diamagnetism

(c) zero resistivity and perfect Diamagnetism   (d) none of the above

(vi) London's equation for penetration depth of superconductors is ...

$$a)H(x) = Hoe^{\frac{x}{\lambda_L}}$$

$$b) H\!\!\!/\!\!\!x = Hoe^{\frac{-x}{\lambda_L}}$$

$$c)H(x) = Hoe^{-\frac{1}{x\lambda_L}} \qquad d)H(x) = Hoe^{\frac{1}{x\lambda_L}}$$

vii) The critical temperature of a superconductor Harish with its isotropic mass M as—----

$$a)\ Tc = M^{-1/2} \qquad b)Tc = M^{1/2} \qquad c)Tc = M^{-1/4} \qquad d)Tc = M^{1/4}$$

(viii) The magnetic lines of force cannot penetrate the body of a superconductor, this phenomenon is known as ....

    (a) isotope effect   (b) London's effect (c) Meissner effect (d) BCS theory

(ix) The phenomenon of superconductor was first discovered by ......

    (a) London   (b) Kamerlingh Onnes   (c) Bardeen (d) Cooper

(x)At critical temperature Tc, the critical magnetic field becomes ....

    (a)infinite   (b) twice the field   (c) zero   (d) negative

(xi) The magnetic field at which superconductivity vanishes is called as—----

    (a) critical magnetic field   (b) superconducting field

    (c) surface field   (d) induced field

(xii) The susceptibility of superconductor is χ= ....

    (a) 0   (b) 1   c)– 1   (d) 3

Q.2 Long answer questions for 8 Marks

i. Define superconductivity, critical temperature and critical magnetic field. Explain how critical magnetic field of superconductor varies with temperature.

ii. What is superconductor? Explain type-I and type-II superconductors.

iii. Explain effect of magnetic field on superconductor. Explain Meissner effect in superconductor.

Q.3 Short answer questions for 4 Marks

i. Explain the effect of magnetic field on superconductors.

ii. State any four uses of superconductors.

iii. State and explain Meissner effect in superconductors.

iv. Explain type-II superconductor.

v. Explain type-I superconductors.

vi. What is penetration depth ? Explain London's equation to study penetration of magnetic field inside the superconductor.

vii. Explain the isotope effect in superconductors.

viii. Explain application of superconductor in 'Magnetic levitation'.

Nanotechnology

1) 1 nm = ... m

    (a) 10^2 (b) 10^{-9} (c) 10^{10} (d) 10^{-10}

2) Nanomaterials are the materials with at least one dimension measuring less than --------

*(a) I nm (b) 10 nm **(c) 100 nm** (d) 1000 nm*

3) Surface to volume ratio of sphere of radius 'r' is-------

(a) 3/r (b) 2/r (c) $3/r^2$ (d) $2/r^2$

4)The melting point of particles in nano form ----------

(a) increases *(b) decreases* *(c) remains same* (d) increases then decreases

5)Which of the following in 1D nanostructure ?

(a) nanowire *(b) nanorod (c) nanoshell* (d) nanotube

6)If the size of nanoparticles is decreased, its surface to volume ratio --------

(a) decreases **(b) increases** *(c) remains same* (d) increases then decreases

7)The first talk about nanotechnology was given by ....

(a) Albert Einstein(b) Newton (c) Gordon Moore **(d) Richard Feynman**

8) Which of the following is an example of top-down approach for the preparation of nanomaterials ?

(a) Ball milling *(b) nucleation and growth (c) Molecular beam epitaxy*

(d) Gas phase agglomeration

9) Which of the following is an example of bottom-up approach for the preparation of nanomaterials ?

(a) Ball milling **(b) nucleation and growth** *(c) Photolithography* (d) Etching

10) Quantum confinement is observed at dimensions below------

(a) 10 nm   **(b) 2 nm**   (c) 1000 nm   (d) 100 nm

11) Quantum dots are .... dimensional nanostructures.

(a) one   **(b) zero**   (c) two   (d) three

12) Decrease in size of quantum dot results in ....

(a) decrease in band gap energy   **(b) increase in band gap energy**

(c) either increase or decrease   (d) constant band gap energy

13) Which of the following is two-dimensional nanostructure ?

(a) nanowire   **(b) nanofilms**   (c) nanotube   (d) nanoparticles

14)Which of the following method is physical method of synthesizing nanomaterials?

(a) Colloidal   **(b) sputtering**   (c) spray pyrolysis   (d) electrodeposition

15. ----------- is the study of phenomenon and manipulation of materials at atomic and molecular scale.

a) nanotechnology   **b)nanoscience**   c) nanobioscience   d)nuclear science

16. If the average crystalline size is about 10 nm then ------- particles needed to prepare $1 cm^2$ nano layer.

(A) 10^9 (B) 10^{12} **(C) 10^{15}**   (D) 10^{18}

Q.2 Long answer questions for 8 Mark

i.   Explain synthesis and growth of Nanoparticles by chemical method with neatdiagram.
ii. Explain the process of ball milling. Give its advantages and disadvantages.

Q.3 Short answer questions for 4 Mark

i.   Explain how the synthesis of Gold(Au) Semiconductor nanoparticles is done usingcolloidal route.

ii. Explain DC glow discharge sputtering.

iii. Explain synthesis of metal nanoparticles by colloidal method.

iv. Explain the working of sputter deposition.

v.   Explain any two applications of nano-materials.

==================== Dr.V.V.Killedar =============================