

**ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.**

**M.Tech. (GREEN ENERGY TECHNOLOGY)**

**COURSE CODE : 307**

Register Number :

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*Signature of the Invigilator*  
(with date)

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**COURSE CODE : 307**

Time : 2 Hours

Max : 400 Marks

*Instructions to Candidates :*

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you -1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. If a balanced coin is flipped twice, what is the probability of getting at least one head  
 (A)  $\frac{3}{4}$  (B)  $\frac{1}{2}$  (C)  $\frac{1}{4}$  (D)  $\frac{2}{3}$
2. Let  $f(x) = \frac{1}{\pi l}$ ,  $0 \leq x < \pi l$  be a probability density function. The probability distribution function  $f(x)$  is  
 (A)  $\frac{x}{\pi l}$  (B)  $\frac{1}{\pi l}$  (C)  $x \pi l$  (D)  $\frac{\pi l}{x}$
3. The expectation value of a constant  $b$  is  
 (A) 0 (B) 1 (C)  $\frac{1}{b}$  (D)  $b$ .
4. The binominal distribution has ----- number of parameters  
 (A) One (B) Two (C) Three (D) Four.
5. What is 2% of 7%?  
 (A) 0.014% (B) 0.14% (C) 1.4% (D) 14%.
6. If  $A^2 - A + I = O$  then the inverse of  $A$  is  
 (A)  $A + I$  (B)  $A$  (C)  $A - I$  (D)  $I - A$ .
7. If roots of the equation  $x^2 - bx + c = 0$  be two consecutive integers, then  $b^2 - 4c$  equals  
 (A)  $1 - 2$  (B) 3 (C) 2 (D) 1.
8. If  $f(x) = \int_a^x \log t \, dt$  for all positive  $x$  then  $f'(x)$  is  
 (A)  $x$  (B)  $\frac{1}{x}$  (C)  $\log x$  (D)  $x \log x$ .
9. If  $\begin{pmatrix} a & -b \\ b & a \end{pmatrix}$  is invertible under matrix multiplication, then its inverse is  
 (A)  $\begin{pmatrix} a & -b \\ b & -a \end{pmatrix}$  (B)  $\begin{pmatrix} a & b \\ -b & a \end{pmatrix}$  (C)  $\frac{1}{a^2 + b^2} \begin{pmatrix} a & b \\ -b & a \end{pmatrix}$  (D)  $\begin{pmatrix} -a & b \\ b & a \end{pmatrix}$ .
10. A function  $f$  is Reimann integrable on  $[a, b]$  if  
 (A) only  $\int_a^b f \, dx$  exist (B) only  $\int_{-a}^b f \, dx$  exist  
 (C)  $\int_a^b f \, dx \neq \int_{-a}^b f \, dx$  (D)  $\int_a^b f \, dx = \int_{-a}^b f \, dx$ .

11. There are 20 people who work in an office together. Four of the people are selected to go to the conference together. How many such selections are possible?  
 (A) 5 (B) 80 (C) 4845 (D) 48450.
12. The Eigen value of  $\frac{d}{dx}(\sin(x))$  is  
 (A) 1 (B) 0 (C) -1 (D)  $i$ .
13. Natural logarithm of -1 is  
 (A) 0 (B) -1 (C)  $i$  (D)  $i\pi$ .
14. If  $y = (x + 3)^2$ , then  $(-2x - 6)^2$  must equal to which of the following  
 (A)  $-4y^2$  (B)  $4y$  (C)  $-2y^2$  (D)  $2y$ .
15. The variance of Poisson distribution is given by  
 (A)  $\sigma^2 = \lambda$  (B)  $\sigma^2 = \frac{1}{\lambda}$  (C)  $\sigma^2 = \frac{-1}{\lambda}$  (D)  $\sigma^2 = 1 - \frac{1}{\lambda}$ .
16. The average incoming call rate is 4 per minute. The probability that there are not more than 3 calls is  
 (A)  $\frac{71}{3} e^{-4}$  (B)  $e^{-6}$  (C)  $-\frac{71}{3}$  (D)  $-e^4$ .
17. The set of real number is  
 (A) Bounded above (B) Unbounded above  
 (C) Finite set (D) Countable set.
18. Composite number  $n$  is  
 (A) A prime number and  $n > 1$  (B) Non- prime number and  $n < 1$   
 (C) Non- prime number and  $n > 1$  (D) A prime number and  $n < 1$ .
19. If  $S$  is a set of real numbers, and  $C_1$  and  $C_2$  are two last upper bounds of  $S$ , then  
 (A)  $C_1 = C_2$  (B)  $C_1 > C_2$  (C)  $C_1 < C_2$  (D)  $C_1 \neq C_2$ .
20. A finite set is  
 (A) Open set (B) Closed set  
 (C) Uncountable set (D) Empty set.

21. What is the ratio of thermal conductivity to electrical conductivity?  
 (A) Prandtl number (B) Schmidt number  
 (C) Lorenz number (D) Lewis number.
22. If the Poisson's ratio is 0.25, then the ratio of shear modulus to the elastic modulus is  
 (A) 0.4 (B) 0.25 (C) 0.5 (D) 1.25.
23. In an autotransformer, power is transferred, through  
 (A) Conduction process only (B) Induction process only  
 (C) Both conduction and induction process (D) Mutual coupling.
24. For the same maximum pressure and heat input, the most efficient cycle is  
 (A) Otto cycle (B) Diesel cycle  
 (C) Brayton cycle (D) Dual combustion cycle.
25. Which of the following power stations is mainly used to cover peak load on the system?  
 (A) Coal based thermal power plant (B) Nuclear power plant  
 (C) Gas based thermal power plant (D) Pumped storage hydropower plant.
26. At a measuring frequency of  $10^{12}$  Hz the dielectric constant of a material will be due to  
 (A) Electronic polarization  
 (B) Ionic polarization  
 (C) Electronic and ionic polarization  
 (D) Electronic, ionic and orientational polarization.
27. Consider the following statements  
 Piezoelectric materials  
 (1) Crystal can be shown as electrical equivalent circuit similar to an inductor and capacitor (Tank circuit)  
 (2) Quartz, Rochelle salt, tourmaline  
 (3) Used in voltage stabilizers  
 (4) This exhibits the reverse effect of electrostriction  
 Which of the above statements is/are correct?  
 (A) 1, 2 and 4 (B) 1 and 2 only (C) 2 and 4 only (D) 1, 2, 3 and 4.

28. What is the function of heavy water in a nuclear reactor?
- (A) It serves as a coolant  
 (B) It serves as a moderator  
 (C) It serves as a coolant as well as a moderator  
 (D) It serves as a neutron absorber.
29. What does application of centrifugal air compressors lead to?
- (A) Large frontal area of aircraft  
 (B) Higher flow rate through the engine  
 (C) Higher aircraft speed  
 (D) Lower frontal area of the aircraft.
30. If reflection coefficient for voltage be 0.6, the voltage standing wave ratio (VSWR) is
- (A) 0.66                      (B) 4                      (C) 1.5                      (D) 2.
31. The measurement of Hall coefficient of a semiconductor with one type of charge carrier gives the information about
- (A) Sign of charge carrier  
 (B) Density of charge carrier  
 (C) Both sign and density of charge carrier  
 (D) Mass of the charge carrier.
32. The standard atmospheric pressure is 762 mm of Hg. At a specific location, the barometer reads 700 mm of Hg. At this place, what does an absolute pressure of 380 mm of Hg corresponds to?
- (A) 320 mm of Hg vacuum                      (B) 382 mm of Hg vacuum  
 (C) 62 mm of Hg vacuum                      (D) 62 mm of Hg gauge.
33. For photoconductors with equal electron and hole mobilities and perfect atomic contacts at the ends, an increase in intensity of optical illumination results in
- (A) Change in open circuit voltage                      (B) Change in short circuit current  
 (C) Decrease in resistance                      (D) Increase in resistance .
34. In case of liquids, what is the binary diffusion coefficient proportional to?
- (A) Pressure only                      (B) Temperature only  
 (C) Volume only                      (D) All the above.
35. If the temperature of a solid surface changes from 27°C to 627°C, then its emissive power changes which ratio?
- (A) 6 : 1                      (B) 9 : 1                      (C) 27 : 1                      (D) 81 : 1.

36. Consider the following statements

Magnetic susceptibility

- (1) Depends on the nature of the magnetic material
- (2) Is not dependent on the relative permeability of the medium
- (3) Cannot be determined by measuring the force exerted on a magnetic material when placed in a magnetic field
- (4) Can be determined from M-H curve

Which of the above statements is/are correct?

- (A) 1, 2, 3 and 4      (B) 1 only      (C) 1 and 4 only      (D) 2 only.
37. Temperature below which certain materials are anti-ferromagnetic is called
- (A) Curie temperature      (B) Neel temperature  
(C) Wein temperature      (D) Debye temperature.
38. In an LC series circuit connected to a dc supply of E volts via a thyristor when it turns off, the voltage that appears across the thyristor is
- (A) + E      (B) + 2E      (C) - E      (D) - 2E.
39. What power would a short shaft, 50 mm in diameter, transmit at 400 r.p.m
- (A) 60KW      (B) 20KW      (C) 40KW      (D) 30KW.
40. Power factor of an alternator driven by constant prime mover input can be changed by changing its
- (A) Speed      (B) Load  
(C) Field excitation      (D) Phase sequence.
41. Which of the following is not an electrophile?
- (A) Br<sup>+</sup>      (B) H<sup>+</sup>      (C) BF<sub>3</sub>      (D) NH<sub>3</sub>.
42. The necessary condition for aldol reaction is
- (A) Aldehyde or Ketone must have an α-H  
(B) Aldehyde or Ketone must have an γ- H  
(C) Aldehyde or Ketone must have an β-H  
(D) None of the above.
43. Anti- Markovnikov's addition of HBr is not observed in
- (A) propene      (B) 1- butane      (C) 2- butane      (D) 2- pentane .

44. The two reactions involved in the Robinson annulations are  
 (A) Hydroboration and oxidation  
 (B) Perkin reaction and Michael reaction  
 (C) Michael reaction and Aldol condensation  
 (D) Oppenauer oxidation and Friedal-craft reaction.
45. The Claisen condensation is often used in preparing  
 (A)  $\beta$ -hydroxyl ester (B)  $\alpha$ -hydroxyl ester  
 (C)  $\gamma$ -keto ester (D)  $\beta$ -keto ester.
46. Which one of the following binary systems forms near ideal solution?  
 (A) n-hexane and n-octane (B) chloroform and water  
 (C) methanol and water (D) acetic acid and water.
47. In the UV spectrum of cyclohexenone, the absorption at  $\lambda_{\text{max}}$ -215 nm is due to the transition of  
 (A)  $\sigma$  to  $\sigma^*$  (B)  $\sigma$  to n (C)  $\pi$  to  $\pi^*$  (D)  $\pi$  to  $n^*$ .
48. Which list below gives only spin active nuclei?  
 (A)  $^1\text{H}$ ,  $^{12}\text{C}$ ,  $^{19}\text{F}$  (B)  $^1\text{H}$ ,  $^{13}\text{C}$ ,  $^{19}\text{F}$  (C)  $^2\text{H}$ ,  $^{35}\text{Cl}$ ,  $^{16}\text{O}$  (D)  $^3\text{H}$ ,  $^{32}\text{S}$ ,  $^{79}\text{Br}$ .
49. What do expect to observe the  $^1\text{H}$  NMR spectrum of chloroethane  $\text{CH}_3\text{CH}_2\text{Cl}$   
 (A) A doublet and a quartet (B) A triplet and a quartet  
 (C) Two doublets (D) A doublet and a triplet.
50. A  $^1\text{H}$ NMR spectrum of compound C contains a singlet, a triplet and a quartet. Which of the following compounds might C be?  
 (A)  $\text{CH}_3\text{CCl}_2\text{CH}_2\text{CH}_3$  (B)  $\text{CH}_3\text{CHClCHCl}_2$   
 (C)  $\text{CH}_3\text{CHClCHClCH}_3$  (D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHCl}_2$ .
51. Which one of acidic auxochromic group?  
 (A) -OH (B) -NO<sub>2</sub> (C) -OR (D) -NH<sub>2</sub>.
52. Reaction of trans-2-phenyl-1-bromocyclo-pentane on reaction with alcoholic KOH produces  
 (A) 4-Phenylcyclopentene (B) 2-Phenylcyclopentene  
 (C) 1-Phenylcyclopentene (D) 3-Phenylcyclopentene.
53. Which organic chloro compound shows complete stereochemical inversion during a  $\text{S}_{\text{N}}^2$  reaction?  
 (A)  $(\text{CH}_3)_3\text{CCl}$  (B)  $(\text{CH}_3)_2\text{CHCl}$  (C)  $\text{CH}_3\text{Cl}$  (D)  $(\text{C}_2\text{H}_5)_3\text{CHCl}$ .

54. Among the following compounds, strongest acid is  
(A)  $C_2H_2$  (B)  $C_2H_6$  (C)  $CH_3OH$  (D)  $C_6H_6$
55. The centre C-atom of carbanion possesses  
(A) Duet of electrons (B) Octet of electrons  
(C) Sexlet of electrons (D) None of the above.
56. Bakelite is obtained by reaction of phenol with  
(A)  $CH_3CHO$  (B)  $HCHO$  (C)  $CH_3COCH_3$  (D)  $CO_2$
57. The most commonly used reagent for vulcanization of natural rubber is  
(A) Carbon black (B) Sulphur (C) Graphite (D) Dry ice.
58. The compound that can easily break ozone molecule is  
(A) Chlorine (B) Oxygen (C) Nitrogen (D) Argon.
59. The agency to look after the climate changes and for action to cut greenhouse gases is  
(A) WHO (B) DOE (C) UNFCC (D) GOI.
60. The world's most abundant fuel is  
(A) Oil (B) Coal (C) Natural gas (D) Methane.
61. Which of the following is not a viral disease?  
(A) Yellow fever (B) Rat fever (C) Small pox (D) Measles.
62. Mitochondria in Eukaryotes is similar to  
(A) Virus (B) Bacteria (C) Moulds (D) Protist.
63. If inheritance of a disease to next generation is only possible through females, the possible inheritance is  
(A) Sex-linked (B) Mendelian (C) Organelle (D) Autosomal.
64. Second most affecting green house gas after  $CO_2$  is  
(A) Methane (B) CFC (C)  $NO_x$  (D) Ozone.
65. Glycoconjugates on proteins in intra-cellular membrane are oriented toward  
(A) Cytoplasmic face (B) Lumen  
(C) Embedded in membrane (D) On both sides.



66. Antibiotic resistance among bacteria represent
- (A) Balancing selection (B) Stabilizing selection  
(C) Directional selection (D) Disruptive selection.
67. According to five kingdom classification of living organism, kingdom MONERA does not include
- (A) Archaeobacteria (B) Blue-Green Algae  
(C) Heterotrophic bacteria (D) Diatoms and golden algae.
68. What is prophage?
- (A)  $\lambda$ - phage DNA  
(B) A transposon  
(C) Stage of a cell cycle  
(D) DNA of temperate phage inserted into host chromosome.
69. An enzyme that phosphorylate protein is known as
- (A) Phosphorylase (B) Phosphatase  
(C) Protein kinase (D) Protein reductase.
70. Enzyme that break down fat to monoglycerides is
- (A) Amylase (B) Carboxypeptidase  
(C) Nuclease (D) Lipase.
71. In DNA analysis if cytosine constitute 20% and Adenosine constitute 18% of all nucleotides, it must be
- (A) Single stranded DNA  
(B) Double stranded DNA  
(C) Very short stretch of double stranded DNA  
(D) Multi chromosomal DNA.
72. When an inorganic molecule other than oxygen accepts hydrogen the process can be classified as
- (A) Fermentation (B) Catalysis  
(C) Anaerobic respiration (D) Aerobic respiration.
73. Identify the Bacterial heat shock response protein from the following
- (A) Hsp (B) RecA (C) Fitz (D) Lac7.

74. When inside of a cell become more negative compared to its resting state, it is said to be
- (A) Depolarized (B) Hyper polarized  
(C) Electric dysfunction (D) Competent.
75. Average time interval between birth of an individual and birth of its off-spring is defined as Generation Time. Generation time of animals in general
- (A) Increases with size of the animal  
(B) Decreases with the size of the animal  
(C) No relationship exists between size and generation time  
(D) It has species-specific relationship.
76. Secondary structure of a protein require
- (A) Hydrogen bonding  
(B) Covalent bonding  
(C) Cross-linkages  
(D) Covalent bonding with Van der Waals forces.
77. The organism *Helicobacter pylori* is associated with
- (A) Diphtheria (B) Sleeping sickness  
(C) Peptic ulcer (D) Leprosy.
78. DNA finger printing technique detects the unique DNA segments known as
- (A) Consensus sequences  
(B) Restriction fragment length polymorphism  
(C) Methylation pattern  
(D) Promoter sequences.
79. Endotoxins in bacteria are
- (A) kind of lipopolysaccharides (B) trans membrane protein  
(C) phospholipase-C analogues (D) protein phosphatase.
80. In polysaccharides, individual monosaccharides are linked by
- (A) Polypeptide bond (B) Glycosidic bond  
(C) Hydrogen bond (D) Phosphodiester bond.
81. The force exerted by two charged particles upon interaction is defined as
- (A)  $kq/r^2$  (B)  $k.q_1 q_2 / r^2$  (C)  $k.v^2 / r^2$  (D)  $ke/r^2$ .

82. "Harmonic motion" of a simple pendulum represents the motion that  
 (A) Runs faster (B) Happens interruptedly  
 (C) Repeat itself in equal intervals of time (D) Repeat itself with time.
83. Quantum confinement in materials are due to the reduction in their  
 (A) Crystallinity (B) Conductivity  
 (C) Dimensions (D) Reflectivity.
84. Quantum confinement in materials results in  
 (A) Electron emission (B) Photon emission  
 (C) Discrete energy levels (D) Energy spectrum.
85. The angle of incidence for which the angle of refraction is  $90^\circ$  is known as  
 ( $\theta_c = \sin^{-1}(n_2/n_1)$ )  
 (A) Refraction angle (B) Transmission angle  
 (C) Absorption angle (D) Critical angle.
86. Optical dispersion of materials arises due to the  
 (A) Light dependence of refractive index  
 (B) Wavelength dependence of refractive index  
 (C) Frequency dependence  
 (D) Density dependence.
87. Grating is a \_\_\_\_\_ optical element  
 (A) Rotating (B) Reflective  
 (C) Dispersive (D) Polarizing.
88. According to the right-hand rule if the index finger represent the vector "a", and the middle finger represents "b" then the thumb represents  
 (A)  $a \times b$  (B)  $a \cdot b$  (C)  $\frac{da}{dt} \cdot b$  (D)  $a \cdot \frac{db}{dt}$ .
89. The integral of the path traveling in a closed loop is  
 (A)  $\oint 2 \pi r dr$  (B)  $\oint A dr$  (C)  $\oint_0^1 A dr$  (D)  $\oint_0^{2\pi} A dr$ .
90. The dimension of electric field is  
 (A) Force per unit charge ( $Nc^{-1}$ ) (B) Force per unit area ( $Nc^{-2}$ )  
 (C) Force per unit metre square ( $Nm^{-2}$ ) (D) Force per unit length ( $NL^{-1}$ ).

91.  $\frac{\Delta v}{\Delta t} = m \cdot \frac{\Delta v}{\Delta t} = ma$  denotes the
- (A) Newton's II<sup>nd</sup> Law of motion (B) Newton's I<sup>st</sup> Law of motion  
(C) Newton's III<sup>rd</sup> Law of motion (D) Kepler's Law.
92. Power (P) of a system is defined as
- (A)  $\frac{Wg}{t}$  (B)  $\frac{W}{t}$  (C)  $\frac{WF}{t}$  (D)  $\frac{Wa}{t}$ .
93. A cup holds 200g of water at 20<sup>o</sup> C, if we use an immersion heater rated at 1000J/s to heat the water, how many joules of heat are required to heat the water to 100<sup>o</sup> C.
- (A) 610 J (B) 600 J (C) 625 J (D) 630 J.
94. One Volt of electronic potential is referred as
- (A) Ohm per metre (B) Amphere per metre  
(C) here x resistance (D) Joules per coulomb.
95. The magnitude (E) of the electric field generated between two oppositely charged parallel plate capacitor is,
- (A)  $E = \frac{\theta E}{A}$  (B)  $E = \frac{\sigma}{\epsilon_0}$  (C)  $E = \frac{\sigma A}{\epsilon_0}$  (D)  $E = \frac{\sigma v}{\epsilon_0}$ .
96. The equivalent capacitance of two capacitors connected in parallel is
- (A)  $\frac{Q}{v}$  (B)  $\frac{Q_1 Q_2}{v}$  (C)  $\frac{v Q_1}{Q_2}$  (D)  $\frac{Q_1}{Q_2}$ .
97. The work done of a capacitor is same as the
- (A) Energy spend by the capacitor (B) Energy stored by the capacitor  
(C) Voltage of the capacitor (D) Voltage per unit time .
98. If a particle travels along a circular path of radius "r" then the speed of the particle can be defined as
- (A)  $\frac{2 \pi r}{T}$  (B)  $\frac{2 \pi r^2}{T}$  (C)  $\frac{2 \pi r^1}{T}$  (D)  $\frac{2/4 \pi r^2}{T}$ .
99. Inductor is a device that stores energy in
- (A) Electric field (B) Ionic field  
(C) Magnetic field (D) Thermal field.
100. Entropy is a measure of
- (A) Heat (B) Randomness  
(C) Energy (D) Heat capacity.