ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2011
EXAMINATION CATEGORY: TECHNICAL

PAPER II: GENERAL SUBJECT KNOWLEDGE for ENGINEERING GROUP

Date	**: 29th October 2011**
Total Marks	**: 100**
Examination Time	**: 1.5 hours**
Reading Time	**: 10 minute**

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. **Do not write** for the first **10 minutes**. This time is to be spent to read the question paper and to check if all questions and pages are correct and intact. Seek any clarifications, if necessary, during this time.

2. The **maximum time** allotted for writing this paper is **1.5 hours**.

3. All answers to the question must be written in the separate **Answer Sheet** provided.

4. This paper consists of **TWO Parts – Part I and Part II**. Part I consists of **70 Multiple Choice Questions** and Part II consists of 10 **Short Answer questions**. **All questions are compulsory.**

5. Every correct answer to the question in Part I shall be awarded ONE (1) mark each and while the correct answer to the question in Part II shall be awarded THREE (3) marks each.

6. While answering the multiple choice questions, write only the letter of the correct answer chosen against the question number, clearly and legibly. Any double writing or smudgy answers shall not be evaluated.

7. The paper has **17** printed pages in all, including this Instruction Page.

PART I- MULTIPLE CHOICE QUESTIONS

Choose the correct answer and write down the letter of the correct answer chosen in the Answer Sheet against the question number. Each question carries ONE (1) mark.

SECTION A: Mathematics

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1. $(a + b + c)^3$ is equal to:

   a) $a^3+b^3+c^3+3(a+b)(b+c)(c+a)$

   b) $a^3+b^3+3ab(a+b)$

   c) $a^2+2ab^3+c^2$

   d) $(a-b)(a^2+b^2+ c^2)$

2. $\left[\left\{\sqrt[4]{x^{-3/4}}\right\}^{-4/3}\right]^4$ equals : a) x^2

   b) x^{-2}

   c) $x^{1/3}$

   d) x

3. The determinant of the matrix $A=\begin{pmatrix} 1 & 3 & -2 \\ 4 & 1 & -1 \\ 5 & -3 & 2 \end{pmatrix}$ is:

   a) -10

   b) - 8

   c) 5

   d) - 6

4. $\frac{\pi}{3}$ radians is same as :

a) 60°

b) 270°

c) 45°

d) 90°

5. Evaluate $\lim_{x \to 0} \frac{\cos x}{x+2}$ is equal to : a) 1

b) ½

c) 3

d) 2

6. Let $y = x^{2/3} + 2x^2$. $\frac{dy}{dx}$ is equal to : a) $x^{-1/3} + 4x$

b) $x + 4x^{2/3}$

c) $5x + x^{2/3}$

d) $\frac{2}{3} x^{-1/3} + 4x$

7. If $\log_a \sqrt{2} = \frac{1}{6}$, a is equal to : a) 4

b) 6

c) 8

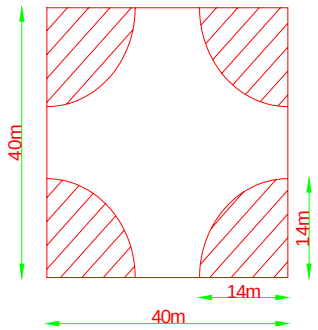
d) 0

8. The total area of unshaded parts will be : a) 1000 m^2

b) 984m^2

c) 780 m^2

d) 1300m^2



9. If $3\begin{pmatrix} x & y \\ z & w \end{pmatrix} = \begin{pmatrix} 4 & x+y \\ z+w & 3 \end{pmatrix} + \begin{pmatrix} x & 6 \\ -1 & 2w \end{pmatrix}$, x is equal to :

a) 4

b) 12

c) 8

d) 2

10. If a line passes through (-3,2) and is perpendicular to the line x + 3y – 5=0, the equation of the line will be :

a) y-x-10=0

b) y-5x+1=0

c) y-3x-11=0

d) y+2x-3=0

11. The mean of 100 observations is 50. If the observation 50 is replaced by 150, the resulting new mean is :

a) 57

b) 151

c) 101

d) 51

12. If $a = 1-\sqrt{2}$, the value of $(a - {}^{1}/a)^{3}$ will be:

a) 16

b) 8

c) 12

d) 9

13. Karma and Mindu appear for an interview for 2 vacancies. The probability of Karma's selection is $\frac{1}{3}$ and Mindu's $\frac{1}{5}$. The probability that only one of them will be selected is:

a) $\frac{2}{3}$

b) $\frac{3}{5}$

c) $\frac{2}{5}$

d) $\frac{1}{7}$

14. For the complex number $\frac{(2+3i)}{(3+2i)}$, the modulus is : a) 1

b) 7

c) 2

d) 3

15. Differentiating the expression $y=e^{\sin x}$ with respect to x gives :

a) sin x
b) $\sin x\, e^{\cos x}$
c) $\cos x\, e^{\sin x}$
d) $\cos x\, e^{x}$

16. $\int \frac{1}{\sqrt{x}} dx$ is equal to : a) $\frac{1}{2x}$ + C where C is constant

b) $2\sqrt{x}$ + C

c) $\sqrt{x}$ + 2

d) $2\sqrt{x}$

17. $\int_0^{\pi/2} \cos x dx$ is equal to :

a) 2

b) sinx

c) 1

d) 0

18. If ω and ω^2 are cube roots of unity, $(2-\omega+2\omega^2)(2+2\omega-\omega^2)$ is equal to:

a) 5
b) 7ω
c) 9
d) ω

19. The value of the determinant $\begin{vmatrix} \cos A & \sin A \\ -\sin A & \cos A \end{vmatrix}$ is equal to:

a) 1
b) $\frac{2}{3}$
c) 2
d) $\frac{1}{3}$

20. The radius and the height of a cylinder are in ratio 2:3. If the volume of the cylinder is 1617cm^3, then the radius of the base of the cylinder will be:

a) 3.5cm
b) 4cm
c) 11cm
d) 7cm

SECTION B: Chemistry

21. Sn is the chemical symbol of

a. Silicon
b. Antimony
c. Tin
d. Strontium

22. ……. is used as a moderator in nuclear reactors

a. Carbon dioxide
b. Boron steel
c. Aluminum
d. Graphite

23. Heating of rubber with Sulphur is known as

a. Galvanization
b. Vulcanization
c. Bessemerization
d. Sulphonation

24. H_2SO_4 has

a. Ionic bond
b. Both ionic and covalent bonds
c. Ionic, covalent and coordinate bonds
d. Covalent bond

25. pH value of a solution whose hydrogen ion concentration is 0.005 moles liter is

a. Below 7
b. 7
c. Above 7
d. None of the above

26. …. ….. states that "the amounts of different substances liberated by the same quantity of electricity are proportional to their equivalent weights."

a. Hess's law
b. Faraday's first law of electrolysis
c. Faraday's second law of electrolysis
d. Faraday's third law of electrolysis

27. Concentrated nitric acid doesn't react with

a. Aluminum
b. Tin
c. Copper
d. Silver

28. Complete the reaction $NaOH + I_2 =$

a. $Na + H_2O + HI$
b. $NaI + HIO$
c. $NaI + H_2O$
d. $Na_2O_3+H_2O+HI$

29. The functional group of Aldehyde is

a. OH
b. RX
c. CHO
d. COOH

30. The common name of the compound C_2H_5OH is

a. methyl alcohol
b. propyl alcohol
c. ethyl alcohol
d. butanol.

31. Biogas is produced by the anaerobic digestion or fermentation of biodegradable materials such as biomass, manure, sewage, municipal waste, green waste, plant material, and crops. Biogas comprises primarily of

a. Ethane
b. Methane
c. Butane
d. Octane

32. Natural rubber is:

a. polyester
b. polyamide
c. Polyisoprene
d. Polysaccharide

33. Buffer solution is a mixture of

a. weak base and weak acid.
b. weak base and strong acid.
c. weak acid and conjugate acid.
d. weak acid and its conjugate base.

34. The correct name for NH_4ClO_4 is

a. Ammonium perchlorate
b. Ammonium Chloric acid
c. Ammonium Chlorate
d. Ammonium Chloric Oxide

35. The isomers have the same

a. structural formula
b. chemical properties
c. molecular formula
d. physical properties

36. Phenol is also called as

a. salicylic acid
b. benzyl alcohol
c. carbolic acid
d. salol

37. Oxidizing action of halogen is in the order:

a. Cl < Br < I < F
b. Cl < I < Br < F
c. I < F < Cl < Br
d. I < Br < Cl < F

38. Which one of the following is the weakest base?

a. NaOH
b. KOH
c. $Ca(OH)_2$
d. $Zn(OH)_2$

39. The free energy change of a spontaneous reaction is

a. = 0
b. > 0
c. < 0
d. None of the above

40. Reaction of H_2 and Cl_2 at the surface of water in the presence of sunlight is an example of

a. Zero order reaction
b. First order reaction
c. Second order reaction
d. Third order reaction

SECTION C: PHYSICS

41. Which of the following properties of a solid would change if it were transported from earth to the moon?

a) mass

b) weight

c) density

d) volume

42. Force per unit mass is equivalent to:
a) Thrust
b) Pressure
c) Density
d) Acceleration

43. A stone of mass 0.2 kg is projected by a catapult with a velocity of $20ms^{-1}$.
The kinetic energy of the stone will be:
a) 60J
b) 40J
c) 55J
d) 70J

44. Two plane mirrors are supported with their surfaces at right angles and a small object is placed between them. How many reflected images of this object can be seen in the mirrors:
    a) 1
    b) 2
    c) 3
    d) 4

45. A ray of light is shone onto a prism. The light cannot be:
    a) deviated
    b) dispersed
    c) focused
    d) reflected

46. Which one of the following examples of electromagnetic radiation has the shortest wavelength?

    a) Radio waves
    b) Infrared
    c) Ultraviolet
    d) X-rays

47. Aap Dorji sees 'steam' start to come from a factory whistle and 3 seconds later he hears the sound. The velocity of sound in air is $360ms^{-1}$. The distance from Aap Dorji to the factory whistle (in meter) is :

    a) 1080
    b) 120
    c) 780
    d) 960

48. Many high buildings are protected from lighting by lightning conductors. Which of the followings about a lightning conductor is not true:

    a) it has a point at its top
    b) is made of copper
    c) is insulated from the building
    d) its lower end is buried in earth

49. The current following through a 4Ω resistor when a potential difference of 6V is applied across it is:

a)1.5A
b) 3A
c) 5A
d) 2A

50. The e.m.f of a cell is quoted as 1.5V. This means that the cell can supply :

a)1.5A of current
b) 1.5 coulombs of charge
c) 1.5 Ω resistance
d) 1.5 joules of energy per coulomb of charge

51. The depolarizer used in a dry cell is:

a) ammonium chloride
b) manganese(iv) oxide
c) zinc chloride
d) carbon

52. An atom of lithium contains 3 electrons, 3 protons and 4 neutrons. Its atomic mass number is:

a) 3
b) 4
c) 7
d) 6

53. Certain atoms emit gamma radiation because:

a) they have large nucleon number
b) their nuclei emit electrons
c) their nuclei contain protons and neutrons
d) their nuclei are unstable

54. How does the frequency and wavelength change when waves in a ripple tank pass through a narrow gap in a barrier:

a) increase
b) decrease
c) unchanged
d) increase and decrease

55. A leaf which contains only a green pigment is illuminated with monochromatic red light. The leaf will appear to be:

a) black
b) green
c) yellow
d) red

56. A concave mirror may be used for all but one of the following:

a) a magnifying mirror
b) a car wing mirror
c)a dentist's mirror
d)a torch reflector

57. When a capacitor is connected to a battery:

a)no current flows in the circuit at all
b) current flows but soon it decreases to zero
c) alternating current flows through the circuit
d) current increases to maximum when capacitor charges to battery voltage

58. Light appears to travel in straight lines because:

a) it is not absorbed by the atmosphere
b) its speed is very high
c) it is reflected by upper part of atmosphere
d) its wavelength is very small

59. The conductivity of semiconductors:

    a) does not depend on temperature
    b) decreases with rise of temperature
    c) increases with rise of temperature
    d) increase with decrease of temperature

60. The core used in transformers is laminated because it:

    a) increases magnetic field
    b) increases the magnetic saturation level of the core
    c) decreases the residual magnetism of the core
    d) decreases the eddy current loss in the core

SECTION D: General IT Knowledge

61. The information stored in ……is erased when the computer is turned off

    a. ROM
    b. RAM
    c. BIOS
    d. CPU

62. Lap top computers fall under which computer hardware generation

    a. First Generation
    b. Second Generation
    c. Third Generation
    d. Fourth Generation

63. USB is a device used to store data and it stands for

    a. Unlimited Service Band
    b. Unlimited Serial Bus
    c. Universal Serial Bus
    d. Universal Service Bus

64. A software or hardware that checks information coming from the Internet or a network and then either turns it away or allows it to pass through to your computer depending on your software or hardware settings is called as:

    a. Antivirus
    b. Firewall
    c. Security system
    d. Spyware

65. Every computer connected to the Internet is identified by a unique four-part string, known as
    a. IP address
    b. Host name
    c. Domain name
    d. None of the above

66. ENIAC was the first general-purpose electronic computer. ENIAC stands for

    a. Electronic Network Interactive Analytic Computer
    b. Electronic Numerical Integrator And Computer
    c. Electronic Network Integrated Analytical Computer
    d. Electronic Numerical Integrated Automatic Computer

67. Which of the following statement is correct?

    a. 1KB = 1024 bytes
    b. 1 MB=2048 bytes
    c. 1 MB = 1000 kilobytes
    d. 1 KB = 1000 bytes

68. Which of the following memories must be refreshed many times per second?

    a. Static RAM
    b. Dynamic RAM
    c. EPROM
    d. ROM

69. .PNG refers to what kind of file?

    a. Image file
    b. Movie/animation file
    c. Audio file
    d. MS Office document

70. A network whose elements may be separated by some distance and usually involves two or more small networks and a dedicated high-speed telephone line is known as

    a. Local Area Network
    b. Wide Area Network
    c. World Wide Web
    d. Metropolitan Area Network

PART II- SHORT ANSWER QUESTIONS

Answer all questions. Answer to all questions must be written in the separate answer sheet provided. Each question carried THREE (3) marks.

1. Differentiate the following function w.r.t x.

$$(4x^3 - 5x^2 + 1)^4$$

2. Solve the integral: $\int \sin^3 x \cos x \, dx$

3. From Paro, Druk Air flies 200km in the direction S52^o 12'E to Bangkok via Kokotta. How far South and how far East to the starting point is it?

4. Monochromatic light of wavelength (λ) =589x10^{-9} is incident from air on a water surface. What are the wavelength, frequency and speed of i) Reflected light ii) Refracted light. The refractive index of water (η) is 1.33.

5. A metal piece and a stone of same size and shape are dropped from the same height near the earth's surface. Which one will reach the earth earlier and why?

6. A brass ball is dropped from the top of a tower 60m high. With what velocity will it strike the ground and how long will it take to reach the ground.

7. What are some of the important applications of electrolysis? Explain briefly.

8. State three differences between nuclear fission and nuclear fusion.

9. Explain what superconductivity is? Give examples of substances which possess superconductivity.

10. What is a hyperlink? How is it created? Give an example.