དཔལ་ལྡན་འབྲུག་གཞུང་།

རྒྱལ་གཞུང་ཞི་གཡོག་ལྷན་ཚོགས།

ROYAL GOVERNMENT OF BHUTAN
ROYAL CIVIL SERVICE COMMISSION

BHUTAN CIVIL SERVICE EXAMINATION 2013
MAIN EXAMINATION
(OCTOBER 13, 2013)

EXAMINATION CATEGORY : TECHNICAL

PAPER II:
GENERAL SUBJECT KNOWLEDGE for
ENGINEERING GROUP

ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2013
EXAMINATION CATEGORY: TECHNICAL

PAPER II: GENERAL SUBJECT KNOWLEDGE for *ENGINEERING* GROUP

Date   : 13 October 2013
Total Marks   : 100
Examination Time : 90 minutes (1.5 hours)
Reading Time   : 15 minutes (prior to examination time)

GENERAL INSTRUCTIONS

1. Write your Registration Number clearly and correctly in the Answer Booklet.

2. The first 15 minutes are to check the number of pages, printing errors, clarify doubts and to read the instructions in Question Paper. You are NOT permitted to write during this time.

3. This paper consists of **TWO Parts, namely Part I and Part II**.
    Part I consists of **70 Multiple Choice Questions** of 1 (one) mark each; and
    Part II consists of **10 Short Answer questions** of 3 (three) marks each.

4. **All questions are compulsory.**

5. All answers must be written in the Answer Booklet provided to you. You will not be given any marks for answers written other than in the Answer Booklet. Ask for additional Answer Booklet if required.

6. All answers should be written with correct numbering of Part, Section and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating any or correct Part, Section and Question Number will NOT be evaluated and no marks would be awarded.

7. Begin each Part in a fresh page of the Answer Booklet.

8. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.

9. You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.

10. This paper has **16** printed pages in all, including this Instruction Page.

GOOD LUCK!

PART I : MULTIPLE CHOICE QUESTIONS

Choose the correct answer and write down the letter of the correct answer chosen in the Answer Booklet against the question number. E.g. 71 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

SECTION A: Mathematics

1. Find the value of following determinant

$$\begin{vmatrix} 2 & 5 & 7 \\ 0 & 1 & -8 \\ 0 & -3 & 4 \end{vmatrix}$$

   a) 47
   b) -40
   c) 2
   d) -7

2. In a box, there are 6 red socks and 4 blue socks, what is the probability of getting 3 red socks in a draw of three socks from the box?

   a) 3/10
   b) 3/6
   c) 1/6
   d) 1/10

3. Evaluate $\sin (\cos^{-1} \frac{3}{5})$

   a) 3/5
   b) 5/3
   c) 4/5
   d) 1

4. Dorji can paint a room in 60 minutes, Karma can paint it in 30 minutes, and Wangmo can paint it in 20 minutes. How much time will they take to paint the same together?

   a) 5 minutes
   b) 10 minutes
   c) 24 minutes
   d) 36 minutes

5. Evaluate $\int \cos 2x \, dx$

   a) $\frac{1}{2} \cos x + c$
   b) $\frac{1}{2} \cos x + c$
   c) $\frac{1}{2} \cos 2x + c$
   d) $\frac{1}{2} \sin 2x + c$

6. Lhamo spends 25% of her salary on housing, 25% on food, 10% on clothing, 20% on fuel and rest on miscellaneous items. If she spends Nu. 2500 on miscellaneous items, her salary is

   a) Nu. 10,500
   b) Nu. 11,500
   c) Nu. 12,500
   d) Nu. 13,500

7. Using the word "BHUTAN", how many words can be formed if all words must begin with the letter "U"?

   a) 720
   b) 540
   c) 120
   d) 60

8. Which of the following fractions is less than $\frac{3}{4}$?

   a) 2/3
   b) 5/6
   c) 7/8
   d) 8/9

9. A worker is paid at a rate of US $ 10 per hour and ½ the rate for any hours worked over 7 hours in a day. If the consultant started working at 9:00 A.M. and left work at 8:18 P.M with 30 minutes lunch break in between. How much will he get paid for that day?

   a) US $ 87
   b) US $ 89
   c) US $ 100
   d) US $ 110

10. A garment store sold 560 ghos on 1st day of school and 800 ghos on 2nd day of school. What is the percent increase in the number of ghos sold by the store?

    a) 30%
    b) 43%
    c) 70%
    d) 143%

11. Factor and solve $2x^2-5x+3 = 0$

    a) (x=5, x=3)
    b) (x=1,x=3/2)
    c) (x=-1, x=-3)
    d) (x=-2,x=-3/2)

12. Convert 135^0 into radians

    a) 2π
    b) $3\pi/4$
    c) $4\pi/3$
    d) $\pi/2$

13. The volume of a cylinder with a radius of 3 cm and height of 4 cm is

    a) 36 cm^3
    b) 75.36 cm^3
    c) 113.11 cm^3
    d) 150.72 cm^3

14. A wire is bent to form a square and the area of a square is 100 cm^2, if the same wire is then used to form a circle, the radius of the circle will be

    a) 4.5 cm
    b) 5.6 cm
    c) 6.4 cm
    d) 10 cm

15. Karma is 8 years older than her sister, if he is 29 years in 2013, in which year was his sister born.

    a) 1984
    b) 1992
    c) 1994
    d) 2005

16. Find the area of the shaded region

6 cm

5 cm

8 cm

_____12 cm_____
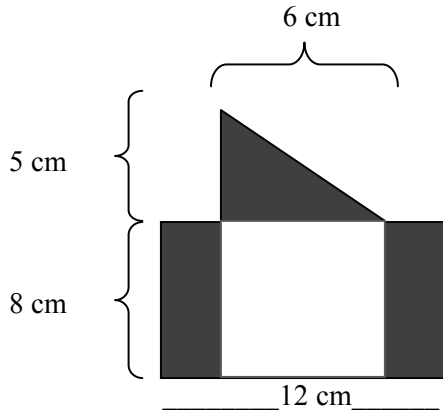
a) 30 cm^2
b) 48 cm^2
c) 63 cm^2
d) 72 cm^2

17. How many subsets does the set { a, e, i, o, u } have?

a) 5
b) 12
c) 26
d) 32

18. The value of $\tan^{-1}(1) + \cos^{-1}(-\frac{1}{2}) + \sin^{-1}(-\frac{1}{2})$ is

a) $\pi/2$
b) $3\,\pi/4$
c) $2\,\pi/3$
d) π

19. The coordinates of a point which divides internally the points (1,3,7) and (6,3, 2) in the ratio 2:3 is

a) (3,3,5)
b) (7,6,9)
c) (3,4,5)
d) (6,9,10)

20. If $y = 4x^3 + 4x^2 + 3x + 10$, d^2y/dx^2 (second derivative) is

    a) $24x + 8$
    b) $12x^2 + 8x + 3$
    c) $12x + 8$
    d) $24x^2 + 3x$

SECTION B: Chemistry

21. Ba is the Chemical symbol of which element?

    a) Boron
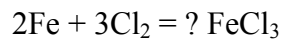   b) Beryllium
    c) Barium
    d) Bromine

22. Atomic Number would refer to the

    a) No. of Protons and Neutrons
    b) Nucleon Number
    c) Proton Number
    d) All of the above

23. Which of the following is not an Alkali Metal

    a) Li
    b) Na
    c) K
    d) I

24. What is the value in place of the question mark for the chemical equation given below:

    $2Fe + 3Cl_2 = ? FeCl_3$

    a) 2
    b) 3
    c) 4
    d) 5

25. When the electrons are either lost or gained, which type of chemical bonds form?

   a) Metallic
   b) Ionic
   c) Covalent
   d) Van Der Waal

26. pH value of the Di-hydrogen Monoxide is generally considered to be:

   a) More than 7
   b) Less than 7
   c) equal to 7
   d) None of the above

27. The formula CH_4 and $C_6H_{12}O_6$ stands for which Hydrocarbons?

   a) Glucose & Sucrose
   b) Benzene & Methene
   c) Methene & Glucose
   d) Benzene & Sucrose

28. Which acid is used for manufacturing TNT, CAN and purifying gold from silver impurities

   a) H_2SO_4
   b) HNO_3
   c) HCl
   d) CH_3COOH

29. In a chemical reaction, what is the role of a catalyst?

   a) To change the Heat of Reaction
   b) To change the Product of the Reaction
   c) To change the Equilibrium Constant
   d) To change the Activation Energy

30. Isothermal Process is best described by which of the following notations:

   a) $\Delta T \neq 0$ but $Q = 0$
   b) $\Delta T = 0$ but $Q \neq 0$

c) $\Delta T \neq 0$ but $Q \neq 0$
d) All of the above

31. Complete the simple reaction $H_2 + Cl_2 =$

a) 2 HCl
b) H_2Cl_2
c) HCl + H
d) Cl_2H

32. Molarity is usually denoted in which of the following units:

a) $[\text{mol L}^{-1}]$
b) $[\text{mol x L}]$
c) $[\text{L / mol}]$
d) $[\text{L x mol}]$

33. According to the Avogadro's Law, which of the following statement is true?

a) Equal volumes of gases under the same conditions of temperature and pressure contain the same number of molecules.
b) The molar volume of all ideal gases at $0°$ C and a pressure of 1 atm. is 22.4 liters
c) Both option (a) and option (b)
d) Neither option (a) nor option (b)

34. Which of the following dissolves in "King's Water" or the "Aqua Regia"?

a) Tantalum and Osmium
b) Gold and Platinum
c) Titanium and Iridium
d) Ruthenium and rhodium

35. The chemical equation given below represents which type of chemical reaction?

$H_2SO_4 + 2 \, NH_4OH = (NH_4)_2SO_4 + 2 \, HOH$
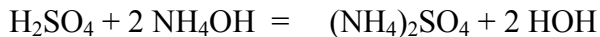
a) Combustion reaction
b) Synthesis reaction
c) Neutralization reaction
d) Decomposition reaction

36. Which of the following has the highest boiling point

    a) Olive oil
    b) Mercury
    c) Water
    d) Oxygen

37. The process of evaporation of a liquid is accompanied by:

    a) An increase in the "Randomness or the disorder of the system"
    b) A decrease in the "Randomness or the disorder of the system"
    c) No change in the free energy
    d) An increase of "sum of the internal Energy"

38. Bauxite, Corrundum and Cryolite are Important ores of which of the following metal

    a) Gold
    b) Silver
    c) Tin
    d) Aluminium

39. If two organic compounds have same molecular formula but different structural formula, they are called?

    a) Isotopes
    b) Isomers
    c) Polymers
    d) Allotrops

40. Which one of the following would give maximum energy in metabolic process?

    a) Lipids
    b) Proteins
    c) Carbohydrates
    d) Vitamins

SECTION C: Physics

41. What force will produce an acceleration of $3.5m/s^2$ in a body of mass 12.5kg?

    a) 40.15
    b) 41.15
    c) 42.75
    d) 43.75

42. What type of electric charge would a glass rod develop, when it is rubbed with silk?

    a) Negative charge
    b) Positive charge
    c) May be positive or negative
    d) No electricity at all

43. Calculate the work done in lifting a mass of 8 kg to a height of 2.5m. Assume g = $9.8m/s^2$

    a) 20 J
    b) 24.5 J
    c) 196 J
    d) 78.4 J

44. Calculate the kinetic energy of a 20 kg mass, moving with a speed of 4m/s?

    a) 160 J
    b) 40 J
    c) 80 J
    d) 784 J

45. Mechanical Advantage of a machine is represented by which of the following notations:

    a) Load x effort
    b) Load/effort
   c) Effort / load
    d) All of the above

46. What is true about the Class III levers:

   a) Effort is in between fulcrum and the load
   b) Fulcrum is in between load and the effort
   c) Load is in between fulcrum and the effort
   d) None of the above

47. Which of the following statement is **Not True** about the liquid pressure?

   a) Depends on depth
   b) Is same in all directions about a point in a liquid
   c) Is inversely proportional to density of the liquid
   d) Is same at all points in a horizontal plane in a liquid

48. A beam of light is incident on an opening as shown in the diagram below. Which device should be used in place of a question mark to produce a tiny spot of light on the screen?
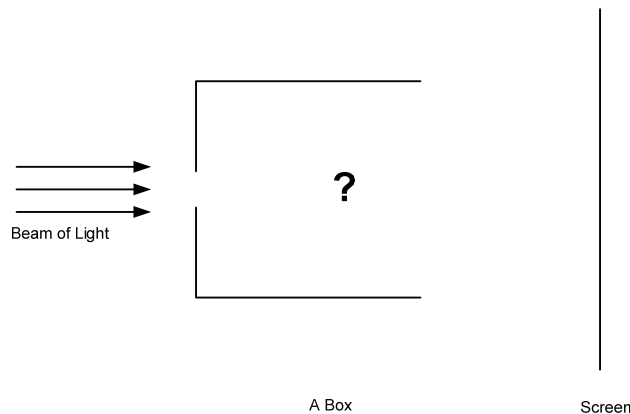
   a) A prism
   b) A concave lens
   c) A convex lens
   d) An opaque sheet

49. The unit of Resistivity is:

   a) Ohm – m
   b) Ohm/m
   c) Ohm
   d) None of the above

50. What is the potential difference required to pass a current of 0.3A in a copper wire of resistance 40W?

    a) 0.0075 V
    b) 133.33 V
    c) 12 V
    d) 120 V

51. A uniform magnetic field is represented by a set of lines which are:

    a) Convergent
    b) Divergent
    c) Parallel
    d) None of the above

52. Which statement is true of an equipotential surface?

    a) Work done in moving any charge from one point to the other on an equipotential surface is infinity
    b) Work done in moving any charge from one point to the other on an equipotential surface is Zero
    c) A line of force is always at parallel to an equipotential surface
    d) All of the above

53. In an electromagnetic wave, the electric and magnetic fields are :

    a) Parallel to each other
    b) Inclined at acute angle
    c) Perpendicular to each other
    d) Inclined at obtuse angle

54. Which of the following does not support the wave nature of light:

    a) Polarisation
    b) Diffraction
    c) Interference
    d) Photoelectric affect

55. Wavelength of light of frequency 100Hz is:

    a) 5×10^6 m
    b) 4×10^6 m
    c) 3×10^6 m
    d) 2×10^6 m

56. Focal length of convex lens is 30cm when measured in air. When the focal length is measured in water, it is?

    a) Less than 30 cm
    b) Greater than 30 cm
    c) Equal to 30 cm
    d) None of the above

57. Cathode rays are:

    a) Beam of atoms moving towards cathode
    b) Beam of electrons emitted by cathode
    c) Is a beam of negatively charged ions moving towards anode
    d) Are electromagnetic waves

58. Which one of the following is used as fuel by the nuclear reactor?

    a) Heavy water
    b) Cadmium
    c) Graphite
    d) Uranium

59. Which one is true about Semi-conductors?

    a) Their valance band is unfilled
    b) Has big gap between conduction band and valance band
    c) Has small gap between conduction band and valance band
    d) None of the above

60. You are dropping a wine glass from the window of your apartment. If you hear the sound of the glass breaking 3.55 seconds after being dropped. Determine the height of your window from the ground level?

   a) 65.30m
   b) 61.75m
   c) 34.79m
   d) 123.50m

SECTION D: General IT Knowledge

61. A "URL" is a formatted text string used by web browsers, email clients and other software to identify a network resource on the Internet. It stands for

   a) Universal Resource Link
   b) Uniform Resource Locator
   c) Unlimited Resource Locator
   d) Universal Reference Link

62. A physical device that joins multiple networks together is called as

   a) Router
   b) Driver
   c) Bluetooth
   d) Cable

63. ……….is a technology that allows telephone calls to be made over computer networks like the Internet.

   a) VoIP
   b) GSM
   c) Modem
   d) CDMA

64. To identify TCP/IP errors such as connection problems…….command can be used

   a) FTP
   b) Ping
   c) POP3
   d) STP

65. A program that runs in the background on your computer, sending information about your browsing habits to the company that installed it on your computer is called as

a) Pop-ups
b) Adware
c) Grayware
d) Spyware

66. Software is a set of programs, which is designed to perform a well defined function and there are two types of software, application and system. The following are all application software except for

a) Microsoft Word
b) Microsoft Excel
c) Microsoft Power Point
d) Microsoft Windows

67. 1 Gigabyte(GB) is equal to

a) 1024 bytes
b) 1024 KB
c) 1024 MB
d) 1024 TB

68. The fourth generation computers are based on

a) Transistor
b) Integrated circuit
c) VLSI microprocessor
d) ULSI microprocessor

69. All the following are computer input devices except for

a) Keyboard
b) Printer
c) Mouse
d) Joy Stick

70. A CD-RW has a speed rating of 12x 10x 32x. What do the three numbers refer to in order?

a) Write, rewrite, read
b) Read, write, rewrite
c) Rewrite, read, write
d) Write, read, rewrite

PART II : SHORT ANSWER QUESTIONS

Answer all questions. Each question carries THREE marks.

1. Divide the number 10 into 2 parts so that the product of the square of the first number and the cube of the second number may be of the greatest possible value.

2. If $y = \sqrt{1 + x^2}$, dy/dx is

3. Assuming that $\log_9(x) = 15$, find the value of $\log_3(\frac{x}{9})$

4. List Three important differences between Atoms and Ions

5. When 5.5 g of a substance dissolved in 50 g of water, it lowered the freezing point of water by 1.15° C. Calculate the relative molecular mass of the substance? *(Note: K_f for water = 1.86° C mol^{-1} Kg)*

6. What is the first law of Thermodynamics? Based on this first law, briefly explain the term
   - i.   Isochoric Process
   - ii.   Adiabatic Process

7. The half-life of one isotope of radium is about 1600 years. In a given sample of this isotope, what will be the time most nearly taken for decaying 15/16 of the radium atoms?

8. If there are two bulbs with the following specification:
   a. Bulb (a) : 100W/220V
   b. Bulb (b) : 1000W/220V
If these bulbs (bulb a & bulb b) are connected in series, which one will glow more brightly?

9. The diagram below depicts the free body diagram of an object having mass = 100 kgs on a very smooth inclined surface. Use the principles of Vector resolution to find the net force (F_{Net}) and Weight or (F $_{gravity}$). (Assume negligible affect of friction and air resistance)
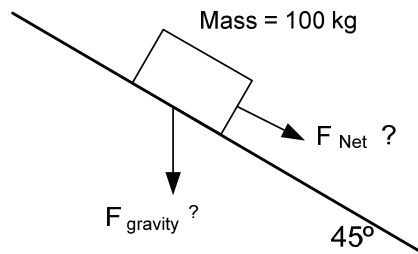
10. Spam is an unsolicited email from an unknown source which can create problems for your computer. Mention 2 ways of preventing such spams.