ROYAL CIVIL SERVICE COMMISSION

BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2010

EXAMINATION CATEGORGY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION for Mechanical Engineering

Date	: **24th November 2010**
Total Marks	: **100**
Examination Time	: **2.5 Hours**
Reading Time	: **10 Minutes**

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. ***First ten minutes** are exclusively for reading the instructions and questions. The candidates are not allowed to write during this period.*
2. *The pages of this question paper are numbered from 1-8 to 8-8 including the cover pages. Report to the invigilator if any pages are found missing.*
3. *This paper consists of two sections namely **Section-A** and **Section-B. Section- A (50 marks)** consist of 30 multiple choice questions of **1 mark** each and four questions of **5 marks** each. Section-B (50 marks) consists of two case studies and candidates are required to attempt only one.*
4. *Mention clearly the question number at the beginning of each answer. For multiple choice questions write the question number followed by answer of your choice in the answer sheet.*
5. *Answer must be written very clearly and support your answers with neat sketches wherever necessary. Use pencils for sketches.*
6. *Candidates are not allowed to write anything on this question paper*

SECTION-A (50 Marks)

***Answer all questions.**

1. **Multiple choice questions (30 marks). Each question carries 1 mark. Write the question number followed by answer of your choice on the answer sheet.**

1) What is the composition of bronze?

a) Copper + Iron

b) Copper + Steel

c) Copper + Zinc

d) Copper + Silver

2) What percentage of carbon is present in pig iron?

a) 0.5 ~ 1 %

b) 1 ~ 1.5%

c) 2 ~ 3 %

d) 4.5 ~ 6%

3) Water is available at 10 m height. What is the pressure available? (g=9.81)

a) 9.81 N/m^2

b) 98.1 N/m^2

c) 9810 N/m^2

d) 98100 N/m^2

4| The power consumed by a electrical device is 1000W at 250 V. What is the resistance in the device?

a) 60 Ω

b) 250000 Ω

c) 4 Ω

d) 62.5 Ω

5) An assembly line is an example of a ..

a) Product focused process

b) Customized process

c) Repetitive process

d) Specialized process

6) A drawing of the movement of material, or people is a ..

a) Process chart

b) Service blue print

c) Process map

d) Flow diagram

7) Strategies for improving productivity in services are ..

a) High interaction, mass customization, service factory, and just in time

b) Lean production, Strategy driven investments, automation, and process focus

c) Separation, Self service, automation, and scheduling

d) Reduce inventory, reduce waste, reduce inspection, and just in time

8) Which one of the following is the purpose of lubrication?

a) to reduce friction

b) to reduce wear

c) to prevent corrosion

d) All the above mentioned

9) The use of information technology to monitor and control a physical process is known as ..

a) Process control

b) Computer Aided design

c) Information numeric control

d) Numeric control

10) "Automatic placement and withdrawal of parts and products into and from designated places in a warehouse" describes ..

a) AGV

b) CAD / CAM

c) CIM

d) ASRS

11) Which one of the following technologies is used only for material handling, not actual production or assembly?

a) Robots

b) CNC

c) CAD

d) AGVs

12) Making environmentally sound products through efficient processes …

a) is known as lean manufacturing

b) can still be profitable

c) is unprofitable, as long as recyclable materials prices are soft

d) is easier for repetitive processes than for product-focused processes

13) Examples of impact of technology on services include

a) supermarket scanners

b) Debit cards

c) Electronic hotel key / lock systems

d) All of the above

14) Which one of the following engineering materials is a synthetic composite.

a) Brass

b) High carbon steel

c) Nylon

d) Stainless steel

15) Identify the type of equipment shown in **fig. 1**

a) Wire feed of MAGS machine
b) Regulator and flow meter of MAGS machine
c) Gun of MAGS machine
d) Power supply of MAGS machine

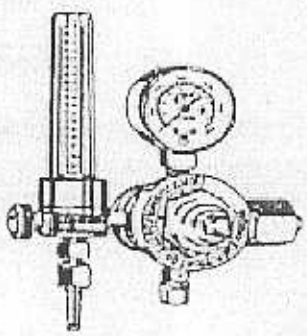


Fig 1

16) ..... are products made from polyvinyl chloride (PVC)

a) Electrical insulation and wiring harnesses

b) Connecting rods

c) Bolt cutter

d) Bicycle frame

17) identify the types of screw threads shown in **fig 2,** (a), (b) and (c)

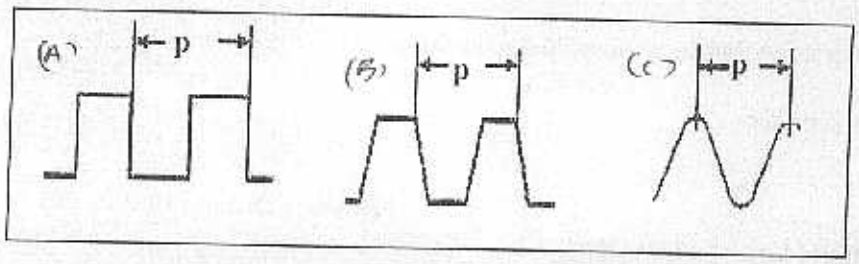


Fig 2

a) Super course ; fine; course

b) Square; ACME ; ISO metric

c) Course; fine; super course

d) ACME; ISO metric: Square

18) What is the main function of the inert gas used in MIGS welding

a) Makes cleaning of the weld easy

b) Keeps contaminants out and prevents oxidation in the weld

c) Reduces heat and stress in the weld

d) Reduces grain growth

19) Tensile stress is stress that acts .....

a) Parallel to a surface

b) Perpendicular to a surface

c) Against the shortening of an object

d) Against the lengthening of an object

20) Identify the type of milling cutter shown in **fig. 3.**

a) Slot drill

b) End mill

c) Side-and- face cutter

d) Shell end mill

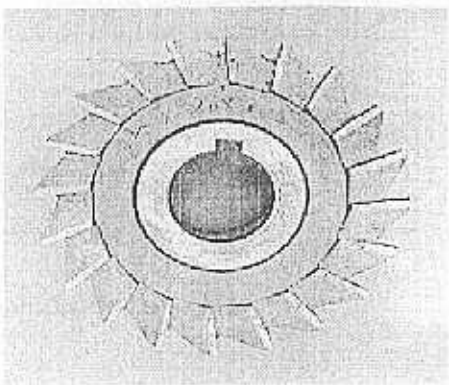


Fig. 3

21) What force is produced by the piston shown in **figure** 4 if the air pressure is 1.2N/mm^2? (Hint: 1 newton / mm^2 = 1 Mpa)

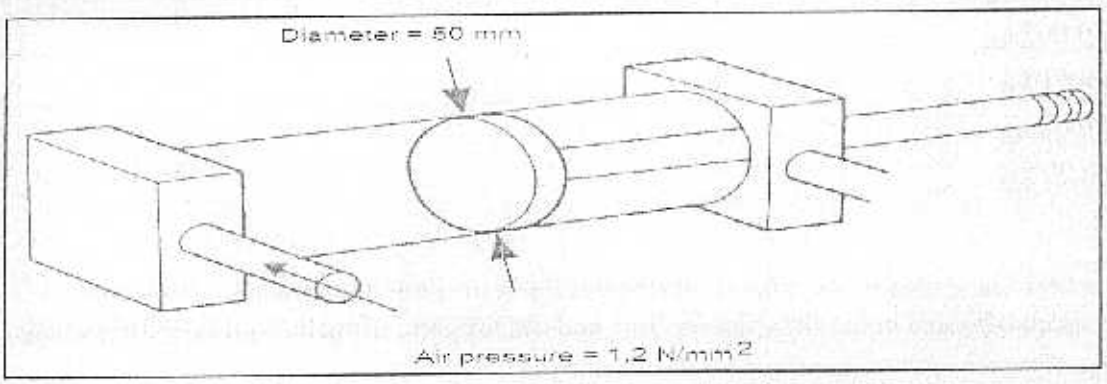


Fig.4

a) 2738.49 N

b) 5632.87 N

c) 3265.91 N

d) 2356.19 N

22) In any Hydro-Power Plant, the energy conversion takes place in a sequence of

a) Mechanical energy - Kinetic energy - Potential energy - Electrical energy

b) Potential energy - Mechanical energy - Electrical energy - Kinetic energy

c) Potential energy - Kinetic energy - Mechanical energy - Electrical energy

d) Electrical energy - Potential energy - Mechanical energy - Kinetic energy

23) Octane number refers to quality of which fuel

a) Diesel fuel

b) Kerosene fuel

c) Coal fuel

d) Petrol / Gasoline fuel

24) A sphere of wax (density 900 kgm^{-3}) has a volume of 20 cm^3. Iron nails are pierced into it so that it *just gets submerged* in water. If the volume of the iron nails is negligible compared to the volume of the sphere of wax, what is the mass of the iron nails in the sphere?

(a) 0.001 kg
(b) 0.002 kg
(c) 0.01 kg
(d) 0.02 kg
(e) 0.09 kg

25) Water is flowing steadily through two horizontal pipes of radii 3cm and 6cm connected in series. The speed of water in the first pipe is 2m/s and the pressure of water in it is 2×10^5 pascal. The pressure of water in the second pipe will be nearly

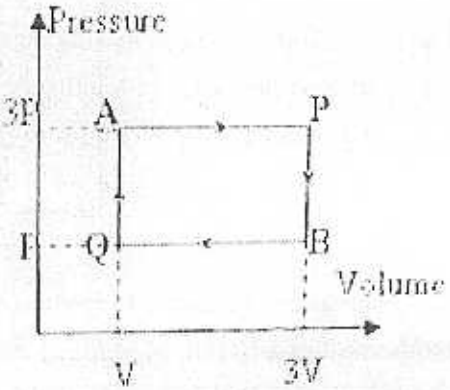
(a) 2×10^4 pascal

(b) 2.2×10^4 pascal

(c) 2.4×10^4 pascal

(d) 2.6×10^4 pascal

26) In the cyclic process on an ideal gas shown in the adjoining PV diagram, what is the net work done on the gas during the cycle?

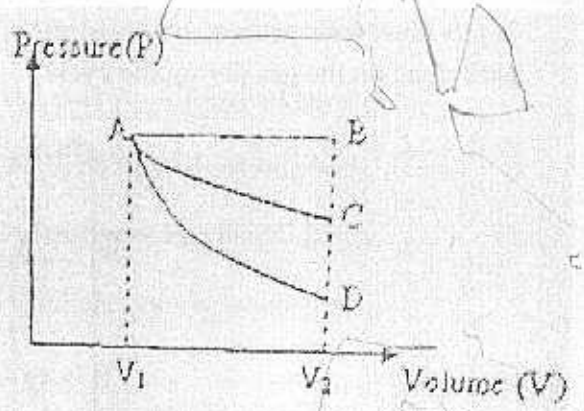


a) 2PV
b) 4PV
c) – 2PV
(d) – 4PV

27) A sample of gas (assumed to be ideal) is adiabatically compressed to have its volume reduced to 20% of its initial volume. If the internal energy of the gas is increased by 200 J, the work done on the gas must be

(a) 40 J
(b) 100 J
(c) 200 J
(d) 400 J

28) The volume of a gaseous sample is reduced from V_1 to V_2 in three different ways: (i) isobaric process (ii) isothermal process and (iii) adiabatic process. Then the work done by the gas is



(a) minimum in the isothermal process
(b) maximum in the isothermal process
(c) minimum in the isobaric process
(d) maximum in the isobaric process

29) When the amplitude of a wave is increased by 50%, its intensity will be *increased by*

(a) 50%
(b) 100%
(c) 125%
(d) 150%

30) The ratio of the actual partial pressure of the water vapour in a space to the saturation pressure of pure water at the same temperature is:

a) Humidity ratio

b) Relative humidity

c) Due point temperature ratio

d) Absolute humidity ratio

2. Short answer questions (20 marks). Answer all four questions. Each question carries 5 marks. Write the question number followed by answer on the answer sheet.

1. A water storage tank has a square hole of side 2 cm at its bottom. A plumber, unaware of the hole, admits water into the tank at a constant rate of $\sqrt{2}$ litre per second. Up to what height can water remain in the tank? ($g = 10\ ms^{-2}$)

2. A bubble rises from the bottom of a lake to the surface, its radius doubles at the surface. The atmospheric pressure is equal to that of a column of water of height H. Show how you can calculate depth ***"h"*** of lake using Boyle's law.

3. What is Biofuel? Explain two types of bio fuel that are used in modern vehicles.

4. Illustrate simple line diagram of a hydraulic machine. List any five basic components of a simple hydraulic machine. Give three example of hydraulics application in modern industries.

SECTION –B (50 Marks)

Following are the two case studies and candidates are required to attempt only one. This case study carries 50 marks.

1. Lots of fuel wood is used in manufacturing of red bricks that are popularly used in constructions in Bhutan. This leads to the burden on forest resources as well as production of carbon dioxide which is contributing to global warming. To discourage the usage of such imported materials whose production is hazardous to environment the Government of Bhutan would like to encourage the usage of local environmentally friendly materials in the booming construction industries.

   Suggest what construction materials would you like to produce in Bhutan to replace these red bricks without adversely affecting the environment. How would you like to involve the local population in such industries that may help to reduce unemployment? How would you encourage the local builders to use the materials that you are proposing to produce locally?

OR

2. The Government of Bhutan is planning to produce ten thousand Megawatt of hydro power energy by 2010. We are also aware of the harsh reality of the ever receding Himalayan glaciers due to global warming. Most of the perennial rivers proposed to run these power plants in Bhutan originate from Himalayan glacial lakes. The unprecedented economic development that would be coming to Bhutan by exporting this huge amount of energy would be in grave danger if these rivers dry up.

   As a planner and manager, how would you like to suggest to the Government to sustain the future development and also for our internal energy security if we are left without hydro power.