ROYAL CIVIL SERVICE COMMISSION
CIVIL SERVICE COMMON EXAMINATION (CSCE) 2009
EXAMINATION CATEGORGY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION for Mechanical Engineering

Date	: **8th November 2009**
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) Which of the following defines the Ideal gas equation
   a) $pv = RT$
   b) $pR = vT$
   c) $pT = vR$
   d) $p = v/RT$

where p = pressure v = Specific volume, T = Absolute temperature, and R = Gas Constant

2) The term used to describe any process during which heat is prevented from crossing the boundary of a system in thermodynamics is
   a) Adiabatic Process
   b) Polytrophic Process
   c) Constant Pressure Process
   d) Isothermal Process

3) The property of a material getting permanently deformed by compression without rupture is known as
   a) Hardness
   b) Toughness
   c) Brittleness
   d) Malleability

4) Newton's Law of Viscosity states that
   a) Shear Stress is directly proportional to the velocity
   b) Shear Stress is directly proportional to velocity gradient
   c) Shear Stress is directly proportional to shear strain
   d) Shear Stress is directly proportional to the viscosity

5) Kinematics viscosity is defined as equal to
   a) Dynamic Viscosity X Density
   b) Dynamic Viscosity / Density
   c) Dynamic Viscosity X Pressure
   d) Pressure X Density

6) Surface tension has a unit of
   a) Force per unit area
   b) Force per unit length
   c) Force per unit volume
   d) None of above

7) Pascal's Law states that pressure at a point is equal in all directions
   a) In a liquid at rest
   b) In a fluid at rest
   c) In a laminar flow
   d) In a turbulent flow

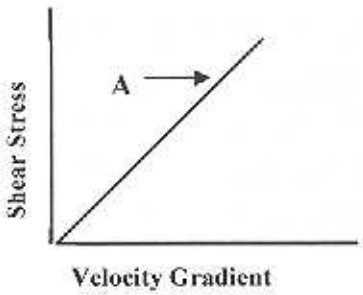
8) Atmospheric pressure held in terms of water column is
   a) 2.8 meters
   b) 8.3 meters
   c) 9.8 meters
   d) 10.3 meters

9) The flow in a pipe is laminar if
   a) Reynold number is equal to 2500
   b) Reynold number is equal to 4000
   c) Reynold number is more than 2500
   d) None of above

10) Mach number is defined as the ratio of
   a) Inertia force to viscous force
   b) Viscous force to surface tension force
   c) Viscous force to elastic force
   d) Inertia force to elastic force

11) Total drag on a body is the sum of
   a) Pressure drag and velocity drag
   b) Pressure drag and friction drag
   c) Friction drag and velocity drag
   d) None of the above

12) Line **A** in the figure corresponds to



   a) Ideal fluid
   b) Newtonian fluid
   c) Non-newtonian fluid
   d) Ideal solid

13) Manometer is a device used for measuring
   a) Velocity at a point in a fluid
   b) Pressure at a point in a fluid
   c) Discharge of a fluid
   d) None of the above

14) Flow of a fluid in a pipe takes place from
   a) Higher level to lower level
   b) Higher pressure to lower pressure
   c) Higher energy to lower energy
   d) None of the above

15) If the fluid particles move in a zig-zag way, the flow is called
   a) Unsteady
   b) Non-uniform
   b) Turbulent
   d) In-compressible

16) Orifice-meter is used to measure
   a) Discharge
   b) Average velocity
   c) Velocity at a point
   d) Pressure at a point

17) Mechatronic is a subject which deals with
   a) Mechanical and Chemical Engineering
   b) Mechanical and Electrical Engineering
   c) Mechanical and Electronic Engineering
   d) Computer and Electronic Engineering

18) Stress is the ratio of
   a) Applied pressure to the column of an element in tension
   b) Applied force to the length of an element in tension
   c) Applied load to the cross-sectional area of an element in tension
   d) None of the above

19) In manufacturing process realizing that many problems are similar and that by grouping similar problems, a single solution can be found to a set of problems, thus to save time and effort. This philosophy is called
   a) Automated Process Technology
   b) Generative Process Technology
   c) Group Technology
   d) Batching Technology

20) A family of tools designed for the purpose of planning and controlling complex project by PERT and CPM is called
   a) Network models
   b) Markov Chains
   c) Queuing models
   d) Simulation models

21) Which of the following is not part of Neo-Classical organization theory

a) Organization is a social system

b) Emphasis on personal, security and social need of workers to achieve organizational goals

c) The organizational behavior is a product of rules and regulations

d) Behavior is a product of feelings, sentiments and attitudes

22) Octane number refers to quality of which fuel

a) Diesel fuel

b) Kerosene fuel

c) Aviation fuel

d) Petrol / Gasoline fuel

23) Cetane number refers to quality of which fuel

a) Diesel fuel

b) Kerosene fuel

c) Coal fuel

d) Petrol / Gasoline fuel

24) 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

25) Fe (Iron) falls under which group in a periodic table

a) Alkali metals

b) Alkali Earth metals

c) Transition metals

d) Metalloids

26) Headstock and tailstock is normally associated with

a) Milling machine

b) Lathe machine

c) Drilling machine

d) Shaper machine

27) When the movement of a work piece against a rotating cutter is involved in a machining Operation, which machine tool is being used

a) Milling machine
b) Lathe machine
c) Drilling machine
d) Shaper machine

28) Most commonly used gas in a gas metal arc welding (GMAW) process is

a) Oxygen
b) Acetylene
c) Hydrogen
d) Carbon Dioxide

29) In a oxy-acetylene welding process, the role of oxygen is

a) Acts as a fuel
b) Acts as a coolant
c) Chemically combines with acetylene to produce heat
d) Acts as a flux

30) Which of a following compound is not a refrigerant

a) Ammonia
b) Carbon monoxide
c) Carbon Dioxide
d) Sulphur Dioxide

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. Explain different strokes of a four stroke cycle engine with reference to spark ignition petrol (gasoline) engine.

2. Define turbine, List four different types of turbine? What type of turbine is generally used in the hydro power plants in Bhutan and why?

3. Define refrigerant, what are the good thermodynamic properties of a refrigerant?

4. What is ABC analysis and how it is applied in inventory control and management?

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. One of the possible ways to encourage Bhutanese youth to take up blue collar jobs and to minimize imported workers in the country is mechanization of the Industries and Construction sector. At present the construction Industry which is the highest employer of blue collar professionals is not mechanized enough. Most of the works are still done manually which is arduous and coupled with poor working condition. It is envisaged that if the construction activities are mechanized, our youth would be keen to take up the profession thereby reducing unemployment and importing foreign workers.

   Suggest how the construction activities in Bhutan can be mechanized. What activities can be mechanized with appropriate machineries. How can we encourage the various stake holders in investing in mechanizing the works?

OR

2. The Government has identified the Jigmeling Industrial belt under Sarpang Dzongkhag to be declared as a Special Economic Zone (SEZ). You as an Entrepreneur would like to set up an Industry there which would involve Foreign Direct Investment by foreign Investors. What type of Industry would you like to set up? What type of support and Input would you expect from the Government?