

**ROYAL CIVIL SERVICE COMMISSION
CIVIL SERVICE COMMON EXAMINATION (CSCE) 2008
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALIZATION for Mechanical Engineering

Date : 20/12/2008
Total Marks : 100
Examination Time : 2.5 hours
Reading Time : 15 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. *First fifteen minutes are exclusively provided 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 page. 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)** consists 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.*
5. *Answer must be written very clearly and support your answers with neat sketches where ever necessary. Use pencils for sketches.*
6. *Candidates are not allowed to write anything on this question paper.*

SECTION-A (50 Marks)

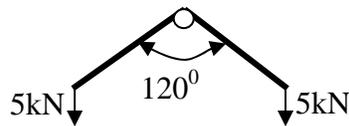
Answer all questions.

I. 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. A branch of physical science which deals with the state of rest or motion of bodies under the action of forces is called

- a) Dynamics
- b) Kinematics
- c) Mechanics
- d) Statics

2. The horizontal component of the following forces is



- a) 10 kN
- b) 0 kN
- c) 5 kN
- d) 15 kN

3. When a body is in equilibrium, the resultant of all forces acting on it is

- a) Equal
- b) Zero
- c) Opposite
- d) Parallel

4. Support that can be removed without destroying the equilibrium condition of the body are said to be

- a) Statically indeterminate
- b) Redundant
- c) Statically determinate
- d) Statically redundant

5. One of the simplest and most useful of machines, which is used to produce small adjustment in the positions of a body as a means of applying large force is
 - a) Lever
 - b) Wedge
 - c) Screw
 - d) Hammer

6. The number of independent coordinates needed to specify completely the configuration of a mechanical system is referred to as the number of
 - a) Coordinate number
 - b) Degree of freedom
 - c) Mechanical Coordinate
 - d) Independent configuration

7. In uniformly accelerated rotation, the angular acceleration is
 - a) Zero
 - b) Constant
 - c) Varying uniformly
 - d) Increasing

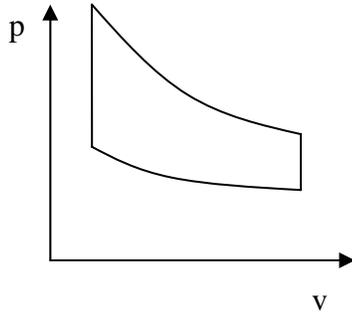
8. A quantity of matter or a region in space chosen for study is called
 - a) Surrounding
 - b) Boundary
 - c) Control Mass
 - d) Thermodynamic System

9. A vapour which is not about to condense is called
 - a) Saturated vapour
 - b) Saturated liquid-vapour mixture
 - c) Superheated vapour
 - d) Hot vapour

10. A device that increases the pressure of a fluid by slowing it down is called
 - a) Nozzle
 - b) Diffuser
 - c) Venturimeter
 - d) Orifice

11. The fraction of the heat input that is converted to net work output is a measure of the performance of a heat engine is called
- Brake Horse Power
 - Indicated Horse Power
 - Performance
 - Thermal Efficiency

12. The following diagram represents



- Diesel Cycle
 - Carnot Cycle
 - Otto Cycle
 - Stirling Cycle
13. The performance of refrigerator and heat pumps is expressed in terms of
- Efficiency of refrigerator
 - Tons of refrigerator
 - Coefficient of Performance
 - Thermal efficiency
14. The refrigerant that is banned for use in refrigerator because of its effect on ozone layer is
- Ammonia
 - Hydrocarbon
 - Carbon dioxide
 - Chlorofluorocarbon
15. The temperature at which condensation begins if the air is cooled at constant pressure is called
- Dew point temperature
 - Condensation temperature
 - Adiabatic saturation temperature
 - Wet-bulb temperature

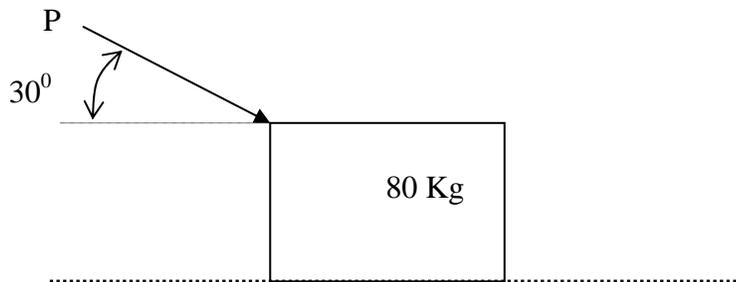
16. The ideal combustion process during which a fuel is burned completely with theoretical air is called
- a) Ideal combustion
 - b) Stoichiometric combustion
 - c) Oxidation
 - d) Complete combustion
17. If Mach number is > 1 , then flow is
- a) Sonic
 - b) Hypersonic
 - c) Subsonic
 - d) Supersonic
18. The time-dependent permanent deformation of material is known as
- a) Creep
 - b) Bending
 - c) Fatigue
 - d) Yield
19. The hardness test that uses a square-based diamond pyramid as the indenter is called
- a) Brinell Hardness Test
 - b) Rockwell Hardness Test
 - c) Meyer Hardness Test
 - d) Vickers Hardness Test
20. Dies that are used to shape the ends of bars and to gather metal at the end is called
- a) Fullering
 - b) Edging
 - c) Swaging
 - d) Bulging
21. A process used to produce short length of hollow shapes such as collapsible tooth paste tubes is called
- a) Hollow extrusion
 - b) Impact extrusion
 - c) Cold extrusion
 - d) Hot extrusion

22. A mechanical member for transmitting a desired motion to a follower by direct contact is called
- a) Gear
 - b) Pulley
 - c) Bearing
 - d) Cam
23. A device used to maintain the speed of an engine within prescribed limit for varying load conditions is called
- a) Flywheel
 - b) Governor
 - c) Brake
 - d) Clutch
24. A joint used to connect two non-parallel, intersecting shafts is called
- a) Flange Joint
 - b) Hinged Joint
 - c) Hooke's Joint
 - d) Ball Joint
25. The welding process that involves exothermic reaction between metal oxides and metallic reducing agents is
- a) Electron – Beam Welding
 - b) Thermit Welding
 - c) Laser-Beam Welding
 - d) Plasma-Beam Welding
26. A machine tool that makes use of Bull Gear is
- a) Lathe machine
 - b) Drilling Machine
 - c) Milling Machine
 - d) Shaper Machine
27. Instrument used to measure surface roughness is
- a) Roughnessmeter
 - b) Surfaceprofilometer
 - c) Profilometer
 - d) Energymeter

28. The latest technology used in diesel engine is
- a) Fuel Injection Pump
 - b) Distributor less
 - c) MPFi
 - d) CRDi
29. Manufacturing process that make use of computer to assist in all phases of manufacturing a product, including process and production planning, machining, scheduling, management and quality control is
- a) Flexible Manufacturing
 - b) Computer Integrated manufacturing
 - c) Computer Numerical Control
 - d) Computer Aided Manufacturing
30. Hydraulic turbine used in Kurichu Hydro Power Plant is
- a) Pelton Turbine
 - b) Francis Turbine
 - c) Kaplan Turbine
 - d) Steam Turbine

II. Short answer questions (20 marks). Each question carries 5 marks. Write the question number followed by answer on the answer sheet.

1. An 80 Kg block rests on a horizontal plane. Find the magnitude of the force P required to give the block an acceleration of 2.5m/sec^2 to the right. The coefficient of kinematic friction between the block and the plane is $\mu = 0.25$. ($\sin 30^\circ = 0.500$, $\cos 30^\circ = 0.866$, $\tan 30^\circ = 0.577$)



2. What is "Cavitation"? How does it affect hydraulic machines and how can it be prevented?

3. Explain the basic components of a common lathe machine and mention the various operations that can be performed on lathe machine.
4. The inner and outer surface temperature of a glass window 5mm thick are 15 and 5 °C. What is the heat loss through a window that is 1m by 3m on a side? The thermal conductivity of glass is 1.4 W/m.k.

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. You are appointed as a Project Manager of Farm Mechanization Project in Bhutan. As a Manager you are assigned with a task to pilot farm mechanization in one of the remote village and come out with observations, issues and recommendations. Explain in about 300 words how you will plan and implement this pilot project.

OR

2. You are the Head of Maintenance Section of a hydro power plant. As Head of Maintenance Section your duty is to make sure the power plant is running without any failures. Failure of power plant results into losses in millions of Ngultrum to the government and the company, so it is very important to keep the machines running without any failures. Even if the machines fail, you should be able to repair the machine at the shortest period of time.

One fine morning you received a desperate call from one of your staff on duty that one of the turbines has failed. Explain in about 300 words, how you will bring back the turbine to operation as soon as possible.