

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, July 2020

Course: Hydraulics & Pneumatics

Program: B.Tech Mechatronics

Course Code: MECH3007

Semester: VI

Time : 03 hrs.

Max. Marks: 100

Instructions:

- (i) There are total of six questions in this question paper. One in Section A and five in Section B
- (ii) Section A will be conducted online on BB Collaborate platform
- (iii) Section B consist of long answer based questions and has the total weightage of 75%. The questions for section B shall also appear in BB Collaborate
- (iv) The maximum time allocated to Section A is one Hrs.
- (v) Section B to be submitted within 24 hrs from the scheduled time.
- (vi) The section B should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sapid at the top (as in the format) and signature at the bottom (right hand side bottom corner)

Section A

1. MCQ

25 Marks

Q1. Mechanical efficiency of pump indicates the amount of energy losses that occur for reasons other than

- (a) Transmission loss
- (b) Energy loss
- (c) Leakage
- (d) Power loss

Q2. A balanced vane pump is one that has

- (a) Two intake and two outlet ports
- (b) One intake and one outlet port
- (c) Three intake and three outlet ports
- (d) Two intake and one outlet ports

Q3. The pumping theory based on the

- (a) creation of partial vacuum
- (b) atmospheric pressure
- (c) gauge pressure

(d) absolute pressure

Q4. The category of dynamic pump is

- (a) Gear pump
- (b) Vane pump
- (c) Piston pump
- (d) Centrifugal pump

Q5. A gear pump has a 75-mm outside diameter , a 50-mm inside diameter , and a 25-mm width. If the volumetric efficiency is 90% at rated pressure , what is the corresponding actual flow rate.

- (a) 0.0553 m³/min
- (b) 0.0576 m³/min
- (c) 0.0676 m³/min
- (d) 0.0776 m³/min

Q6. The desirable properties of hydraulic fluid is

- (a) Ideal viscosity
- (b) High volatility
- (c) High density
- (d) Toxicity

Q7. The primary function of hydraulic fluid is

- (a) Transmit power
- (b) Adding heat
- (c) Avoid seal clearances between mating parts
- (d) Resist motion

Q8. Hydraulic actuator is a device which converts mechanical energy into

- (a) Motion
- (b) Power
- (c) Torque
- (d) Friction

Q9. The hydraulic cylinder cushions prevents excessive

- (a) Impact
- (b) Force

- (c) Momentum
- (d) Position

Q10. A hydraulic shock absorber is a device that brings a moving load to a gentle rest through the use of

- (a) Metered hydraulic fluid
- (b) Position control
- (c) Stroke control
- (d) Pressure control

Q11. A hydraulic motor has a 82 cm^3 volumetric displacement . If it has a pressure rating of 70 bars and it receives oil from a $0.0006 \text{ m}^3/\text{s}$ theoretical flow rate pump , find the motor theoretical power.

- (a) 4.20 kW
- (b) 5.20 kW
- (c) 6.20 kW
- (d) 7 kw

Q12. Pressure control valves protect the system against

- (a) Pressure
- (b) Stroke
- (c) Velocity
- (d) Discharge

Q13. The simplest type of direction control valve is a check valve, which is a two –way valve because it contains

- (a) One port
- (b) Two ports
- (c) Three ports
- (d) Four ports

Q14. The pressure control valve maintain reduced pressures in specified locations of hydraulic system

- (a) Pressure reducing
- (b) Unloading valve
- (c) Counterbalance valve
- (d) Sequence valve

Q15. The valve which is designed to cause a hydraulic system to operate in a pressure sequence

- (e) Pressure reducing
- (f) Unloading valve
- (g) Counterbalance valve
- (h) Sequence valve

Q16. Valves are used to regulate the speed of hydraulic cylinders and motors by controlling the flow rate to these actuators.

- (a) Direction control valve
- (b) Pressure control valve
- (c) Flow control valve
- (d) Check valve

Q17. A hydraulic circuit is a group of components such as

- (a) pumps, actuators, control valve, and conductors
- (b) pumps, control valve, and conductors
- (c) pumps and conductors
- (d) None

Q18. When analyzing or designing a hydraulic circuit, what is the important consideration.

- (a) Safety of operation
- (b) Economy
- (c) Efficiency
- (d) All of the above

Q19. Pneumatic power packs consist of

- (a) Compressor and pressure release valve
- (b) Compressor and filter regulator
- (c) Compressor and distributor
- (d) Compressor and tube

Q20. A lubricator ensures proper lubrication of internal moving parts of

- (a) Pneumatic component
- (b) Hydraulic component
- (c) Cylinder piston
- (d) None

Q21. A pneumatic exhaust silencer is used to control the

- (a) Noise
- (b) Smoke
- (c) Flow
- (d) Heat

Q22. The main application of the Aftercoolers is

- (a) Cool the hot air
- (b) Wet the air
- (c) Add the moisture
- (d) None

Q23. For the pneumatic cylinder –driven power tool, at what rate can reciprocation take place. The following data apply:

- a. Piston diameter=44.5mm
- b. Piston stroke=152mm
- c. Air pressure and temperature =687kPa gage and 27°C
- d. Available flow rate=0.0555 standard m³/min(cfm of air at standard atmosphere condition of 101kPa abs 20 °C)
 - (a)30 cycles/min
 - (b) 40 cycle/min
 - (c) 50 cycle/min
 - (d)60 cycle/min

Q24. A hydraulic motor has a displacement of 164 cm³ and operates with a pressure of 70 bars and a speed of 2000 rpm. If the actual flow rate consumed by the motor is 0.006m³/s and the actual torque delivered by the motor is 170 N.m, find the actual power delivered by the motor

- (a)35.6kW
- (b) 37.8 kW
- (c) 40 kW
- (d) 42.5 kW

Q25. The application of double pump hydraulic system is

- (a) Sheet metal punch

- (b) Drilling
- (c) Cutting
- (d) Milling

Section B

Attempt all the questions

2. Design a pneumatic circuit to accomplish the following operations:

- (a) The cylinder rod moves left when only V1 is actuated
- (b) The cylinder rod moves right when only V2 is actuated
- (c) The cylinder rod stops moving when a single valve is actuated
- (d) When both valves are actuated, the cylinder is free

15 Marks

3. A pneumatic vacuum lift system uses six suction cups, each having a 100mm lip outside diameter and a 80mm lip inside diameter. The vacuum system is to lift large steel sheet weighing 1500 N. The total volume inside the cup cavities and associated pipelines up to the vacuum pump is 0.20m^3 . If a factor of safety of 3 is used, what flow rate must the vacuum pump deliver if the time required to produce the desired vacuum pressure is 2minute. 15 Marks

4. Design the meter out hydraulic circuit, which uses a suspended load, determine the pressure on each pressure gage during constant speed extension of the cylinder for

- (a) No load
- (b) 20000 N load

15 Marks

5. Design the pneumatic circuit to crush a car body into bale size using a 152mm diameter hydraulic cylinder. The hydraulic cylinder is to extend 2.54 m during a period of 10s. The time between crushing strokes is 5 minute. The following accumulator gas absolute pressure are given;

P_1 =gas precharge pressure=84 bars absolute

P_2 = gas charge pressure when pump is turned on=210bars absolute= pressure relief valve setting

P_3 =minimum pressure required to actuate load=126 bars absolute

- (a) Calculate the required size of the accumulator

(b) Pump hydraulic power and the flow requirement with and without accumulator. 15 Marks

6..A double acting hydraulic cylinder is hooked up in the regenerative circuit. The cracking pressure for the relief valve is 60 bar. The piston area is 25cm^2 and the rod area is 7cm^2 . The pump flow is 20lpm. Design the regenerative circuit and determine the cylinder speed , load carrying capacity during the

(a) Extending stroke

(b) Retracting stroke

15 Marks