17005

BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – Dip.ME-2022
Course Name – Power Engineering
Course Code - DMEPC602
(Semester VI)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Identify the type of engine that primarily uses the Otto cycle.
a) Diesel engine b) Petrol engine
c) Gas turbine engine d) Steam engine

(ii) State the P-V diagram represents in an I.C. engine.
a) Pressure-Volume relationship during combustion b) Temperature-Volume relationship
c) Work done by the engine d) Heat dissipation in the engine

(iii) Name the type of fuel system used in a multi-point fuel injection (M.P.F.I.) engine.
a) Carburettor b) Fuel Injection Pump
c) Electronic fuel injection system d) Vaporizer

(iv) Define the key function of a catalytic converter.
a) Increase the engine efficiency b) Reduce emissions of harmful gases
c) Improve fuel consumption d) Increase engine power

(v) State the number of strokes required to complete one cycle in a four-stroke engine.
a) One b) Four
c) Three d) Two

(vi) Name the component in a diesel engine responsible for fuel injection.
a) Carburetor b) Fuel Injection Pump
c) Ignition coil d) Spark plug

(vii) Define the primary function of a steam nozzle.
a) Increase pressure b) Convert thermal energy into kinetic energy
c) Reduce velocity d) Store steam

(viii) Identify the critical pressure ratio for steam nozzles.
a) 0.528 b) 0.628
c) 0.728 d) 0.828

(ix) Describe the working principle of a diffuser.

a) Increase velocity and decrease pressure
b) Decrease velocity and increase pressure
c) Store steam
d) Reduce temperature

(x) Recall the function of the blades in an impulse turbine.

a) Increase pressure
b) Convert kinetic energy into mechanical work
c) Store steam
d) Reduce velocity

(xi) State the formula for sonic velocity in a fluid.

a) γRT
b) γP
c) γT
d) γR

(xii) Calculate the Mach number if the steam velocity is 500 m/s and the speed of sound is 350 m/s.

a) 1.43
b) 1.53
c) 1.63
d) 1.73

(xiii) Calculate the efficiency of a simple impulse turbine if the work done is 200 kJ/kg and the enthalpy drop is 250 kJ/kg.

a) 80%
b) 85%
c) 90%
d) 95%

(xiv) Recall the purpose of regeneration in a gas turbine.

a) Increase thermal efficiency
b) Decrease thermal efficiency
c) Increase pressure
d) Decrease temperature

(xv) Define the primary function of a hydraulic turbine.

a) Convert hydraulic energy into mechanical energy
b) Convert mechanical energy into electrical energy
c) Convert thermal energy into mechanical energy
d) Convert electrical energy into hydraulic energy

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Calculate the sonic velocity of steam if the specific heat ratio (γ) is 1.3 and the gas constant (R) is 461 J/kg·K at a temperature of 500 K. (3)
3. Name the thermodynamic cycle used in gas turbines. (3)
4. Sketch a labelled schematic flow diagram of an open cycle gas turbine. (3)
5. List the types of I.C. engines based on the fuel used. (3)
6. Analyze the effect of increasing the nozzle exit area on the steam velocity in a convergent-divergent nozzle. (3)

OR

Analyze the effect of supercharging on the performance of a diesel engine. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Propose a method for governing a steam turbine to maintain constant speed under varying loads. (5)
8. Demonstrate the effectiveness of superheating and reheating in improving steam turbine efficiency. Propose a design for a multi-stage turbine that incorporates these techniques. (5)
9. Design and propose an improved scavenging method for two-stroke diesel engines to minimize exhaust emissions and fuel wastage clearly explaining your proposed solution. (5)
10. Demonstrate the velocity diagrams and work done by a Pelton Wheel turbine. Solve the power output of a Pelton Wheel given a jet velocity of 100 m/s and a runner speed of 50 m/s. (5)
11. Explain the concept of Mach number and its significance in steam nozzle design. (5)

12. Evaluate the thermal efficiency of a Dual Combustion Cycle engine with a compression ratio of 15, constant volume heat addition ratio of 1.4, and constant pressure heat addition ratio of 1.3. Assume γ = 1.4. Justify your results clearly. (5)

OR

Critically assess the impact of valve overlap duration on volumetric efficiency and emissions in four-stroke petrol engines. (5)

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