THERMAL POWER ENGINEERING (SEMESTER - 4)

CS/B.Tech (EE-O)/SEM-4/ME-411/09

1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | | |

CS/B.Tech (EE-O)/SEM-4/ME-411/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

THERMAL POWER ENGINEERING (SEMESTER - 4)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B			Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

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Head-Examiner/Co-Ordinator/Scrutineer

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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Water required for attemperation is taken from

a) Boiler drum b) Economizer

c) Feed pump d) Any one of (a) and (b). ☐

ii) Specific fuel consumption is defined as

a) Fuel consumption in gm/hr to the HP delivered

b) Fuel consumed in gm/sec to the IHP generated. ☐

iii) Compounding in impulse steam turbine is done for

a) controlling turbine speed

b) better working fluid utilization

c) controlling steam temperature

d) none of these. ☐

iv) The thermal efficiency of the closed cycle gas turbine is

a) $1 - (1/r)^{(\gamma-1)/\gamma}$ b) $1 - (r)^{(\gamma-1)/\gamma}$

c) $(r)^{(\gamma-1)/\gamma} - 1$ d) $1 + (r)^{(\gamma-1)/\gamma}$ ☐

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v) Thermal efficiency of a good steam generator may be

a) 90%

b) 50%

c) 40%

d) 25%.

vi) For natural draft system the maximum discharge through the chimney of flue gases occurs when

a) Chimney is as short as possible

b) Chimney is as tall as possible

c) Chimney is equal to the hight of hot column produce draft.

vii) Function of feed check valve is

a) to check the water feed rate to boiler drum

b) to feed water to boiler at high pressure but check the same escaping back through it

c) to check the level of water in boiler drum

d) to check the steam flowing out from use.

viii) The main function(s) of condenser is/are

a) to create vacuum

b) to maintain vacuum

c) to condense steam to water for reuse

d) all of these.

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ix) Parson's steam turbine is

a) a simple impulse steam turbine

b) a simple reaction steam turbine

c) velocity compounding steam turbine

d) pressure compounding steam turbine. ☐

x) The gas turbine with regenerator improves

a) thermal efficiency

b) work ratio

c) avoid pollution

d) none of these. ☐

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Describe briefly different boiler accessories.

3. What are the functions of a superheater in steam power plant ? Discuss its location with the help of schematic diagram.

4. Derive an expression of power required at the blade to run a turbine.

5. What are the pollutants in the automotive engine exhaust ? How are they controlled ?

6. Explain the principle of cyclone separator.

7. Describe briefly the working principle of an ESP with a neat sketch.

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GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. a) Derive an expression for the efficiency of diesel cycle in terms of cut-off and compression ratio.

b) During testing a two stroke diesel engine with rope break dynamometer, the following observations were recorded :

Engine speed = 700 rpm

Diameter of brake drum = 600 mm

Diameter of rope = 50 mm

Dead load on the brake drum = 35 kg

Spring balance reading = 4·5 kg

Find the power available at the brake in kW. 8 + 7

9. a) Sketch Lancashire boiler neatly and label all the major components.

b) Equivalent evaporation of a boiler at 100°C is 10·5 kg/kg of fuel. When the actual evaporation is 9·0 kg/kg of fuel, the boiler produces steam at 20 bar from feed water at 40°C. Find the quality of steam produced by the boiler. 8 + 7

10. a) Derive an expression for the following in a single stage impulse steam turbine and also velocity diagram.

i) Force

ii) Work done

iii) Diagram efficiency.

b) What is meant by compounding of steam turbine ? Show the pressure and velocity variation curves of a multistage impulse steam turbine. State the various types of compounding used in impulse steam turbine. 8 + 7

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11. a) Determine the expression of thermal efficiency for a closed cycle gas turbine.

b) In a closed cycle gas turbine the following data apply :

Working substance = Air ; C_p = 1 kJ/kg-K

Ambient temperature = 27°C

Top temperature = 823°C

Pressure at compressor inlet = 1 bar

Pressure ratio = 4

Compression ratio = 80%

Turbine efficiency = 85%

Heating value of fuel = 41800 kJ/kg.

Heater loss = 10% of the heating value.

Find the following :

i) Compression work

ii) Heat supplied

iii) Turbine work

iv) Thermal efficiency

v) Air : Fuel ratio. 8 + 7

12. An engine working on Otto cycle is supplied with air at 1 bar, 35°C. The compression ratio is 8. Heat is supplied at 1500 kJ/kg. Calculate the maximum pressure and temperature of the cycle, the cycle efficiency and mean effective pressure.

(For air C_p = 1·005 kJ/kg-K, C_v = 0·718 kJ/kg-K and R = 0·287 kJ/kg-K). 15

13. Draw a layout diagram of a modern thermal power station. 15

END

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