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A – 6569

Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, October 2016

(2013 Scheme)

13.307 : THERMAL ENGINEERING (MU)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** questions carry **2** marks. **(10×2=20 Marks)**

1. What is critical pressure ratio in steam nozzler ?
2. Sketch Rankine cycle and write down the equation for efficiency.
3. What is dual combustion cycle in IC engines ?
4. Sketch Stirling cycle.
5. Explain the working of Wankel engine.
6. What is adiabatic flame temperature ?
7. What do you understand by octane rating of fuel ?
8. Explain ignition lag in IC engines.
9. Write down the equation for thermal efficiency of Brayton cycle. Sketch the cycle.
10. Explain intercooling in gas turbine engines.

PART – B

Answer **any one** question from **each** Module. **All** questions carry **equal** marks.

(20×4=80 Marks)

Module – I

11. a) For a simple impulse turbine nozzle, prove that the maximum blade efficiency $\eta_{b\,max} = \frac{k}{2}\cos^2\alpha$.

b) With the help of neat sketch, explain the governing of steam turbines.

OR

12. a) With the help of neat sketches, explain any three boiler mounting and accessories.

b) The velocity of steam leaving the nozzles of an impulse turbine is 1250 m/s and the nozzle angle is 20°. The blade velocity is 370 m/s and the blade coefficient is 0.75. Assuming no loss due to shock at the inlet, calculate the

i) blade inlet angle

ii) driving force on the wheel

iii) axial thrust on the wheel

iv) power developed by the turbine.

The mass flow rate of steam is 1.63 tonnes/h.

Module – II

13. a) Derive an expression for air-standard efficiency for Otto cycle.

$$\eta_{otto} = 1 - \left(\frac{1}{r}\right)^{\gamma-1}.$$

b) A gasoline engine working on Otto cycle has a cylinder diameter of 200 mm and a stroke of 250 mm. If the clearance volume is 1400 cc, find the air standard efficiency.

OR

14. a) Differentiate between Morse test and retardation test.

b) Compare the petrol and diesel engines with reference to the following :

i) power to weight ratio

ii) method of fuel introduction

iii) method of ignition.

Module – III

15. a) Ethane (C_2H_6) is burnt with just twice the stoichiometric amount of air. How much (kg) air is used to oxidise 6 kg of the fuel ?

b) Briefly explain the effect of engine variables on detoration.

OR

16. Write short notes on :

i) Knocking in CI engines.

ii) Ignition lag

iii) LPG and CNG fuels

iv) Cetane rating

v) Flash and fire points.

Module – IV

17. a) Sketch the Brayton cycle and derive an expression for thermal efficiency

$$\eta_{th} = 1 - \left(\frac{1}{R_p}\right)^{\frac{\gamma-1}{\gamma}}$$

b) A constant pressure closed cycle gas turbine engine plant works between the temperature range of 800°C and 30°C. If isentropic efficiency of compressor and turbine are 80% and 90% respectively, find the pressure ratio of the cycle for maximum thermal efficiency and maximum specific output of the cycle. Assume air as the working medium.

OR

18. a) What are the advantages and disadvantages of gas turbines over IC engines ? What are the field of application of gas turbines ?

b) An open cycle constant pressure gas turbine works between the pressure ranges of 1 bar and 6 bar and temperature range at 300 K and 1023 K. The calorific value of fuel used is 43000 kJ/kg. Find the following

i) A/F ratio

ii) Thermal efficiency of the plant

iii) kW generating capacity of the plant if the flow rate is 10 kg/s.