Total Pages : 32

21 - I

21

Optional Paper

Mechanical Engineering

Paper – I

Time : 3 Hours | Maximum Marks : 200

IMPORTANT NOTES / महत्वपूर्ण निर्देश

(A) Please fill up the OMR Sheet of this Question Answer Booklet properly before answering. Please also see the directions printed on the obverse before filling it.
प्रश्नोत्तर पुस्तिका में प्रश्न हल करने से पूर्व उसके संलग्न ओ.एम.आर. पत्रक को भली प्रकार भर लें । उसे भरने हेतु उसके पृष्ठ भाग पर मुद्रित निर्देशों का अध्ययन कर लें ।

(B) The question paper has been divided into three Parts - **A, B** and **C**. The number of questions to be attempted and their marks are indicated in each part.
प्रश्न-पत्र अ, ब और स तीन भागों में विभाजित है । प्रत्येक भाग में से किये जाने वाले प्रश्नों की संख्या और उनके अंक उस भाग में अंकित किये गये हैं ।

(C) Attempt answers in **English**.
उत्तर अंग्रेजी भाषा में से दीजिये ।

(D) Answers to all the questions of each part should be written continuously in the script and should not be mixed with those of other parts. In the event of candidate writing answers to a question in a part different to the one to which the question belongs, the question will not be assessed by the examiner.
उत्तर पुस्तिका में प्रत्येक भाग के समस्त प्रश्नों के उत्तर क्रमवार देने चाहिये तथा एक भाग में दूसरे भाग के उत्तर नहीं मिलाने चाहिये । एक भाग में दूसरे भाग के प्रश्न के उत्तर लिखे जाने पर ऐसे प्रश्न को जाँचा नहीं जा सकता हैं ।

(E) The candidates should not write the answers beyond the limit of words prescribed in parts **A, B** and **C** failing this the marks can be deducted.
अभ्यर्थियों को भाग अ, ब और स में अपने उत्तर निर्धारित शब्दों की सीमा से अधिक नहीं लिखने चाहिये। इसका उल्लंघन करने पर अंक काटे जा सकते हैं ।

(F) **In case the candidate makes any identification mark i.e. Roll No./Name/Telephone No./Mobile No. or any other marking either outside or inside the answer book, it would be treated as resorting to using unfair means. In such a case his candidature shall be rejected for the entire examination by the Commission.**
अभ्यर्थी द्वारा उत्तर पुस्तिका के अंदर अथवा बाहर पहचान चिन्ह यथा – रोल नम्बर / नाम / मोबाईल नम्बर / टेलीफोन नम्बर लिखे जाने या अन्य कोई निशान इत्यादि अंकित किये जाने को अनुचित साधन मान जायेगा। आयोग द्वारा ऐसा पाये जाने पर अभ्यर्थी की सम्पूर्ण परीक्षा में अभ्यर्थिता रद्द कर दी जायेगी ।

SEAL सील

PART – A

Marks : 40

Note : Attempt all the **twenty** questions. Each question carries **2** marks. Answer should not exceed **15** words.

1 What is the relation between COP (Coefficient of Performance) of refrigerator and COP (Coefficient of performance) of heat pump?

2 Write four processes of stirling cycle.

3 Define flow work.

4 Give the definition of Grashof number.

5 Give the unique value of Prandtl number when Colburn and Reynolds analogies are the same.

6 Define radiosity.

7 Write a definition of draught.

8 Write a relation between work ratio and back work radio.

9 Give definition of binding energy.

10 How will you define the degree of saturation?

11 Name three fluids used in vapour absorption refrigeration system.

12 What is the meaning of one ton of refrigeration?

13 Define Magnus effect.

14 Give a definition of angle of zero lift.

15 Write a relation between static pressure, stagnation pressure and dynamic pressure.

16 Define eddy Kinematic viscosity.

17 Define wicket gates used in hydraulic machines.

18 What is the purpose of doing priming in a centrifugal pump?

19 Write a relation of net positive suction head (NPSH).

20 Define cavitation.

PART – B

Marks : 60

Note : Attempt all the **twelve** questions. Each question carries **5** marks. Answer should not exceed **50** words.

21 Derive an expression for the intermediate temperature for reversible carnot cycle arranged in series when (i) the net work of the two power cycles is equal. (ii) the thermal efficiencies of the two power cycles are equal.

22 What are the limitations of carnot cycle for vapours?

23 Draw the boiling curve and identify the different boiling regimes.

24 What is the physical significance of Prandtl number? Does the value of the Prandtl number depend on the type of flow ?

25 Name the direct and indirect methods of solar energy utilization. Explain them briefly.

26 Define radioactive decay, radioisotopes and half life.

27 Discuss the advantages and disadvantages of ammonia refrigerant.

28 Prove that

$$\phi = \frac{\mu}{1-(1-\mu)\frac{p_{ws}}{p}}$$ where ϕ = Relative humidity μ = Degree of saturation.

29 What is vapour pressure? What is its significance in flow problems?

30 Define and draw a neat sketch for showing the induced drag.

31 What are the limitations of Petten wheel turbine?

32 Explain why the air valve is mounted on the cover plate of Kaplan turbine.

PART – C

Marks : 100

Note : Attempt any **5** questions. Each question carries **20** marks. Answer should not exceed **200** words.

33 Draw and explain the following graphs showing the effect of thermal efficiency of Rankine cycle on the boiler pressure, condenser pressure and degree of superheat.

34 What is the difference between
(a) Evaporation and boiling (b) Pool boiling and flow boiling
(c) Subcooled and saturated boiling (d) Film and dropwise condensation

35 Explain by drawing schematic and T-s diagram for improving efficiency and the net work by modification in the simple gas turbine cycle by intercooling, reheating, regeneration and combined intercooling reheat and regeneration.

36 What do you mean by separation of boundary layer? What is the effect of adverse pressure gradient on boundary layer?

37 Define hydrodynamically smooth and rough boundaries with reference to
(i) Reynolds roughness number (ii) Reynolds number with reference to roughness
(iii) Nikuradse's experimental results.

38 What are the characteristic types of cavitation for hydraulic machines? Describe stages and prevention of cavitation.

39 How is speed of a reaction turbine regulated? What is the disadvantage in this method of governing? How is it rectified in Kaplan turbine governing mechanish by drawing a neat sketch?

SPACE FOR ROUGH WORK / रफ कार्य के लिए जगह

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