PART - I

Paper Code
10
Subject
Mechanical Engg. - II

400421

PART - II

Subject : Mechanical Engg. - II

400421

Paper Code:	10
Total Pages :	
Time	3 Hours
Maximum Marks :	200

TO BE FILLED BY THE CANDIDATE

Roll No. (In words)	
Name of the candidate	
Date of Birth (DD/MM/YYYY)	
Father's Name	
Signature of the candidate	
Date of Examination	

Roll No.

0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

Invigilator must check the Roll No. and Photo ID. of the candidate, then Sign. here :

TO BE FILLED BY INVIGILATOR

If candidate found using unfair means them Invigilator should fill up this bubble with black/blue ball pen & report to the Centre Superintendent:

IMPORTANT NOTES
महत्त्वपूर्ण निर्देश

(A) Please fill up the OMR Sheet of this Question-Answer Booklet properly before answering.
प्रश्नोत्तर पुस्तिका में प्रश्न हल करने से पूर्व उसके संलग्न ओ.एम.आर. पत्रक को भली प्रकार से भर लें ।

(B) The question paper is divided into different unit and parts. The number of questions to be attempted and their marks are indicated in each unit and parts.
प्रश्न-पत्र विभिन्न यूनिट एवं भागों में विभाजित है । प्रत्येक यूनिट एवं भाग में से किये जाने वाले प्रश्नों की संख्या और उनके अंक उस यूनिट एवं भाग में अंकित किये गए हैं ।

(C) Attempt answers either in **Hindi or English**, not in both. For Language Papers, answer in concerned language and script, unless directed otherwise to write in Hindi or English specifically.
उत्तर **अंग्रेजी या हिन्दी** भाषा में से किसी एक में दीजिये, दोनों में नहीं । भाषा विषयक प्रश्नों के उत्तर उनकी संबद्ध भाषा व लिपि में ही दिए जाएँ, जब तक कि प्रश्न विशेष के लिए अलग से हिंदी या अंग्रेजी में उत्तर देने के लिए न लिखा गया हो ।

(D) The candidates should not write the answers beyond the prescribed limit of words; failing this, marks will be deducted.
अभ्यर्थियों को अपने उत्तर निर्धारित शब्दों की सीमा से अधिक नहीं लिखना चाहिए । इसका उल्लंघन करने पर अंक काटे जायेंगे ।

(E) Please write answers only in the prescribed space of booklet. Do not write any mark of identity inside the Answer Script (including Paper for rough work) i.e. name, address, telephone number, Name of God etc. or any irrelevant words other than the answer of question. Such act will be treated as unfair means. The Commission may also deduct 5 marks from the marks obtained, if Roll Number is not filled correctly on the O.M.R. Sheet.
किसी भी प्रश्न का उत्तर प्रश्नोत्तर पुस्तिका में निर्धारित स्थान पर ही लिखें । प्रश्नोत्तर पुस्तिका (रफ़ कार्य के पृष्ठ सहित) के अंदर कहीं पर भी अपना नाम, रोल नंबर अथवा अन्य कोई पहचान चिह्न यथा -- प्रश्नोत्तर में नाम, पता, दूरभाष नंबर, देवताओं के नाम अथवा अन्य कोई भी प्रश्नोत्तर से असम्बंधित शब्द, वाक्य एवं अंक आदि न लिखें । ऐसा करने पर आयोग द्वारा इसे अनुचित साधन अपनाने का कृत्य माना जायेगा । ओ.एम.आर. पत्रक पर रोल नम्बर का त्रुटिपूर्ण अंकन करने पर आयोग द्वारा उसके प्राप्तांकों में से 5 अंक भी काटे जा सकते हैं ।

(F) Candidates are directed that they should not write (answer) out side the border line in every page. Answer written out side the border line will not be checked by the Examiner.
अभ्यर्थियों को निर्देशित किया जाता है कि प्रश्नोत्तर पुस्तिका में प्रत्येक पृष्ठ में बनाई गई बार्डर लाईन से बाहर प्रत्युत्तर नहीं लिखें । बार्डर लाईन के बाहर लिखे गये उत्तर को परीक्षक द्वारा जाँचा नहीं जायेगा ।

(G) If there is any sort of ambiguity/mistake either of printing or factual nature then out of Hindi and English version of the question, the English version will be treated as standard.
यदि किसी प्रश्न में किसी प्रकार की कोई मुद्रण या तथ्यात्मक प्रकार की त्रुटि हो तो प्रश्न के हिन्दी तथा अंग्रेजी रूपान्तरों में से अंग्रेजी रूपान्तर मान्य होगा ।

(H) It should be ensured that the Question-Answer Booklet is provided in a sealed envelope to the candidate.
अभ्यर्थी यह सुनिश्चित कर लें कि अभ्यर्थी को प्रश्नोत्तर पुस्तिका सीलबंद लिफाफे में प्रदान की गई है ।

(I) Candidate should fill up all desired details on this attached OMR sheet of Question-Answer Booklet with **blue** ball point pen. Please ensure that this OMR Sheet is not torn or damaged.
अभ्यर्थी प्रश्नोत्तर पुस्तिका के ऊपर संलग्न इस ओ.एम.आर. पत्रक पर सभी वांछित विवरण **नीले** बॉल पेन से सावधानीपूर्वक भरें । ध्यान रखें कि यह ओ.एम.आर. पत्रक कहीं से कटे-फ़टे नहीं अथवा किसी भी प्रकार से क्षतिग्रस्त नहीं हो ।

(J) This **OMR** Sheet consists of **Two** parts, in which some information is pre-printed; remaining details have to be filled by the candidate.
यह **ओ.एम.आर.** पत्रक **दो** भागों में बंटा है, जिसमें कतिपय सूचनाएँ पूर्वमुद्रित हैं । शेष की पूर्ति अभ्यर्थी को करनी है ।

(K) If the Question-Answer Booklet is torn or not printed properly, bring it to notice of invigilator and change the Question-Answer booklet, otherwise the candidate will be liable for that.
यदि प्रश्नोत्तर पुस्तिका कहीं से कटी-फटी या अमुद्रित है, तो अभिजागर के ध्यान में ला दें तथा उसे बदलवा ले, अन्यथा उसका दायित्व अभ्यर्थी का होगा ।

विशेष नोट :

अभ्यर्थी द्वारा यदि ओ.एम.आर. पत्रक पर गलत सूचना भरी जाती है या उसे किसी प्रकार की क्षति पहुँचाई जाती है अथवा उस पर किसी प्रकार का पहचान चिह्न अंकित किया जाता है, तो आयोग द्वारा संपूर्ण परीक्षा हेतु अभ्यर्थिता निरस्त की जा सकेगी और उसके लिए अभ्यर्थी उत्तरदायी होगा ।

Special Notes :

If there is any wrong information filled by the candidate or any attempt is made to damage it or any marking as identification is done, then his candidature for the entire examination shall be rejected by the commission, for which he will be liable.

SPACE FOR ROUGH WORK

Paper – II
MECHANICAL ENGINEERING – II

(Total 200 Marks)
(Total 37 Question)

PART – A

Note : Attempt **all** questions. Answer the following questions in **15** words each. Each question carries **2** marks.

Very Short Answer Questions :

1. What is Wet Bulb Depression ?

2. Give two examples each of extensive and intensive properties.

3. Mention any four causes of irreversibility.

4. What is the temperature (K) and pressure (mm of Hg) at the triple point of water ?

5. What is the physical significance of Peclet number ?

6. Define specific gravity of a fluid.

7. What do you understand by intensity of radiation ?

8. What is the function of Economiser in Boilers ?

9. Define fin efficiency and fin effectiveness.

10. Which reactor has no moderator ?

11. What do you understand by Cetane number ?

12. What are the basic differences between refrigeration and air-conditioning ?

13. Define Diversity factor of a power plants.

14. In which condition the load factor and capacity factor will be numerically equal ?

15. What do you understand by scavenging in I.C. engines ?

16. What do you understand by ram efficiency in air refrigeration system ?

17. What is the physical significance of the number of transfer units (NTU) for a heat exchanger ?

18. Define specific speed of a turbine.

19. How much buoyant force acts on fully submerged body ?

20. How is a Pelton turbine stopped ?

PART – B

Note : Attempt **all** questions. Answer the following questions in **50** words each. Each question carries **5** marks.

Short Answer Questions :

21. What would happen to the temperature of an insulated room if the door of a refrigerator is left open ?

22. Which type of condensation is associated with high rate of heat transfer and why ?

23. Explain the momentum thickness.

24. Why do we use draft tube in turbines ?

25. What do you understand by ignition lag ?

26. Which type of emissions are more prominent in diesel engines and why ?

27. Write down any five advantages of Pulverized coal firing system in thermal power plants.

28. Why do we have Surge tanks in hydraulic power plants ?

29. Write down the corollary of Carnot theorem.

30. Explain the third law of thermodynamics.

31. What is the use of flash chamber for gas removal in a vapour compression refrigeration cycle ?

32. Check whether the following function satisfies the continuity and is a valid potential function $\phi = A(\text{Cos } x + \text{Sin y})$, where A is a numerical constant.

PART – C

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

Long Answer Questions :

33. In a cogeneration binary cycle, superheated steam enters the turbine with a mass flow rate of 5 kg/s at 440 °C and 40 bar and expands isentropically to 1.5 bar. Half of the flow is extracted at 1.5 bar and used for industrial process heating. The remaining steam passes through a heat exchanger which serves as the boiler of refrigerant-12 cycle and the condenser for the steam cycle. The condensate leaves the heat exchanger as saturated liquid at 1 bar, where it is combined with the return flow from the industrial process at 60°C and 1 bar before being pumped isentropically to the steam generator. The R-12 cycle is an ideal Rankine cycle with refrigerant entering the turbine at 16 bar. 100 °C and saturated liquid leaving the condenser at 9 bar. Determine (a) the net power output of the binary cycle (b) the rate of heat transfer in the steam generator (c) the rate of heat transfer to industrial process.

34. Derive an expression for temperature distribution in a circular conical rod with diameter at any section given by $D = ax$, where x is the distance measured from the apex of the cone and 'a' is a certain numerical constant. It may be presumed that there is no internal heat generation, steady state conditions prevail and that the lateral surface is well insulated.

10 20

35. Following data is given for Francis turbine. Net head H = 60 m, Speed N = 700 RPM, Shaft power = 294.3 kW, overall efficiency = 84%, Hydraulic efficiency = 93%, flow ratio = 0.2, breadth ratio = 0.1, outer diameter of runner = 2 times of inner diameter of runner. The thickness of vanes occupies 5% of circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet.

Determine :

(i) Guide blade angle

(ii) Runner vane angles at inlets and outlets

(iii) Diameter of runner at inlet or outlet

(iv) Width of wheel at inlet and degree of reaction

36. The following data refer to summer air conditioning of a building :

Outside design conditioning = 43°C DBT, 27.5°C WBT

Inside design conditioning = 25°C DBT, 50% RH

Room sensible heat gain = 20 kW

Room latent heat gain = 5 kW

By-pass factor of cooling coil = 0.1

The return air from room is mixed with outside air before entering into cooling coil in the ratio of 4:1 by mass. Determine (a) Apparatus dew point of the cooling coil (b) Exit conditions of air for cooling coil (c) fresh air mass flow rate and (d) refrigeration load on the cooling coil.

37. What do you understand by mean effective pressure (m.e.p.) ? Obtain the expression for m.e.p. for air standard Otto cycle.

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK