



**QDB – 33**

**MECHANICAL ENGINEERING**

Duration : 3 Hours]

[Total Marks : 200

- Instructions :** 1) 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.
- 2) Medium of question paper is “**English**”. Please write in **English language only**.
- 3) Answer to all 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 questions in a part different to the one which the question belongs, the question shall not be assessed by the examiner.
- 4) The candidate should write the answer within the limit of words prescribed in the parts “**A**”, “**B**” and “**C**”.
- 5) **Use of Non programmable calculator is permitted.**

PART – A

**Marks : 40**

- Instructions :** 1) Question No. **1 to 20**.
- 2) Attempt **all 20** questions.
- 3) **Each** question carries **2** marks.
- 4) Answer should be given approximately in **20 to 30** words.

1. What is the difference between local acceleration and convective acceleration in fluid mechanics ?
2. What is the main function of draft tube ?
3. State corollary of Carnot’s theorem.
4. What is the difference between psychometric process in desert cooler and air conditioner ?
5. What are the main parameters need to be maintained in the biomass digester ?
6. Write electricity flow analogy in case of heat transfer by conduction.
7. What is the range of wavelength of thermal radiation and visible light ?

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8. State the condition for a perfect two dimensional truss along with an example.
9. Define point of contra flexure. What will be the value of shear force at this point ?
10. What is the difference between accuracy and precision ?
11. State and briefly explain the concept of vibration isolation.
12. State the principle of interferometry.
13. List the five types of gears and its applications.
14. What is Reynolds number ? Write the ranges of Reynolds number for laminar and turbulent flow.
15. What are the specific limitations of solar energy ?
16. Write Kelvin Planck's statement of Second Law of thermodynamics.
17. Write a brief note on powder metallurgy and its use in industries.
18. What do you understand by factor of safety ?
19. Briefly describe the characteristics of C language and the reason for its use as a professional language.
20. Write a note on friction drives.

## PART – B

Marks : 60

- Instructions :** 1) Question No. 21 to 32.  
2) Attempt **all 12** questions.  
3) **Each** question carries **5** marks.  
4) Answer should be given approximately in **50 to 60** words.

21. The tool signature of a single point cutting tool as per American Standards Association (ASA) is given below :

$10^\circ - 20^\circ - 7^\circ - 6^\circ - 8^\circ - 15^\circ - 0.8 \text{ mm}$

Draw well- labelled diagrams of Top view, Front view and Side view of this single point cutting tool.



22. Draw the stress-strain curves for the following engineering materials.  
i) Mild steel,                      ii) Aluminium and                      iii) Cast iron.  
Are strength and stress material properties ?
23. “In sand casting process, Sprue is designed tapered”. Do you agree with the statement ? Justify your answer recalling fundamentals for fluid mechanics.
24. Define cold working. Draw a figure showing the effect of cold working on the mechanical properties (Tensile strength, Yield strength, and % Elongation) of pure copper.
25. Differentiate between boiler mountings and accessories.
26. a) Which is the basis on which a fluid machine is termed as a turbine or a pump (or compressor) ?  
b) What is meant by rotodynamic fluid machine and positive displacement type fluid machine.
27. What do you mean by critical thickness of insulation over a cylindrical pipe ?
28. Describe step by step procedure for dynamic force analysis of four bar mechanism.
29. Draw neat sketch of Oldham coupling and explain its constructional features. List the various advantages and disadvantages of Oldham coupling.
30. In gas welding of mild steel using oxy-acetylene flame, the total amount of acetylene consumed was 20 litre. What would be the oxygen consumption from the cylinder ? Justify your answer.
31. How does domestic solar water heater works ?
32. Which of the non-traditional machining operation among USM, EDM and ECM is mainly used to machine GLASS ? Draw its schematic diagram.

PART – C

Marks : 100

- Instructions :** 1) Question No. 33 to 39.  
2) Attempt **any 5** out of 7 questions.  
3) **Each** question carries **20** marks.  
4) Answer should be given approximately in **200** words.

33. The speeds and feeds selected for boring operation on a lathe are generally less than those recommended for turning operation. Explain reasons recalling fundamentals for deflection of beams.



34. What is the difference between reaction and impulse turbines ? Show that maximum hydraulic efficiency of pelton wheel turbine is  $(1 + \cos \beta)/2$ , where  $\beta$  is the bucket angle from horizontal direction.
35. a) Draw well labelled Iron-Carbon equilibrium diagram. Draw the cooling curve for pure iron.  
b) "Quenching is always followed by tempering heat treatment process". Do you agree with the statement ? Justify in either case.
36. Compare the efficiency of Otto and Diesel cycles for constant compression ratio and heat rejection.
37. a) Explain the meaning of  
i) feasible solution  
ii) basic feasible solution while solving transportation problems.  
b) Solve the following LPP by graphical method.  
Minimize  $Z = 20X_1 + 40X_2$   
Subject to constraints  
 $36X_1 + 6X_2 \geq 108$   
 $3X_1 + 12X_2 \geq 36$   
 $20X_1 + 10X_2 \geq 100$   
 $X_1, X_2 \geq 0$ .
38. Draw the Merchant's circle diagram for orthogonal machining and state Merchant's model assumptions. Derive equations for various forces using the Merchant's circle. Also derive equation for shear stress on the shear plane for orthogonal machining.
39. A mild steel spur gear having 51 teeth and 2 mm module is to be machined on milling machine.  
  
Calculate gear proportions (blank diameter, pitch circle diameter, tooth height) and machining particulars (indexing procedure, cutting speed, feed rate and depth of cut) for satisfactory machining.
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