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B.Tech. VII-Sem. (Main) Examination, December - 2023
Mechanical Engineering
7ME5-11 I.C. Engines

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

*Attempt **all ten** questions from **Part A**, **five** questions out of **Seven** questions from **Part B** and **Three** questions out of **Five** questions from **Part C**.*

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

PART - A

(Answer should be given up to 25 words only)

All questions are **compulsory.** **(10×2=20)**

1. Give the classification of IC engines.
2. Draw theoretical and actual PV diagram of Otto cycle.
3. Write Indian standards of emissions from motor vehicle?
4. What is the ignition limits of hydrocarbon fuel in IC engine?
5. Differentiate between swirl and turbulence.
6. Write the types of carburetors used in SI engines.
7. What are the different methods of fuel injection in CI engines?
8. What is the spark advance?
9. Write down the firing orders for a four cylinder and a six - cylinder engine.
10. Write down the rating of SI and CI engine lubricating oils.

PART - B

(Analytical/Problem solving questions)

Attempt any **FIVE** questions. **(5×4=20)**

1. Explain energy balance in IC engine with respect to first law of thermodynamics.
2. What are the different methods of determining the friction power and indicating power of IC engines? Explain Morse test for finding indicating power of a six - cylinder engine.
3. What is the ignition lag in SI engine combustion? What are the factors that affect ignition lag? Explain.
4. What is the delay period in CI engine combustion? What is the effect of long delay period on combustion process in CI engine?
5. Compare carburation system of fuel feed vs injection system of fuel feed in SI engine.
6. Draw and explain battery ignition system for a SI engine.
7. Explain scavenging process in 2-stroke engine.

PART - C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any **Three** questions. **(3×10=30)**

1. Draw the three stages of combustion in SI engine on P-θ diagram. Compare theoretical and actual diagrams. Explain all three stages in detail.
2. What are the various factors that affect the second stage of combustion "Flame Propagation" in CI engine? Explain in detail. Also draw Time - distance diagram of flame propagation in combustion chamber.
3. Describe and illustrate the four phases of combustion in a compression ignition (CI) engine. The comprehensive air - fuel ratio undergoes a shift from approximately 100:1 during no load conditions to 20:1 at full load in CI engines. Elaborate on the combustion process in a CI engine, especially considering a petroleum fuel with an upper ignition limit of 30:1.
4. Write the name of different lubrication system in IC engine. Explain and draw pressurised (wet) lubrication system in IC engine.
5. Draw and explain the construction and working of wankel rotary engine.

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B.Tech. VII-Sem. (Back) Examination, December - 2023
Mechanical Engineering
7ME5-11 I.C.Engines

Time : 3 Hours

Maximum Marks : 120
Min. Passing Marks : 42

Instructions to Candidates:

Attempt All Ten questions from Part A, Five questions out of Seven from Part B and Four questions out of Five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

PART - A

(Answer should be given up to 25 words only)

ALL questions are Compulsory. **(10×2=20)**

1. Differentiate between SI and CI engines.
2. Draw PV diagrams of Otto cycle and diesel cycle.
3. Write the formulae of finding thermal, mechanical and volumetric efficiencies of IC engine.
4. What is the ignition delay in SI engine combustion?
5. What is the MPFI in SI engine?
6. Write the names of carburetors used in SI engines.
7. What is the significance of firing order?
8. Draw valve timing diagram for 4-stroke SI engine.
9. Why cooling is needed in IC engine?
10. What is dual fuel engine?

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PART-B

(Analytical/Problem Solving questions)

Attempt any FIVE questions. **(5×8=40)**

1. Explain energy balance in IC engine and draw heat balance sheet for a SI engine.
2. Compare Ignition delay of SI engine with Delay period of CI engine.
3. Explain detonation in SI engine.
4. Explain combustion chamber design in CI engine?
5. Draw and explain Solex Carburator.
6. Draw and explain different methods of supercharging in CI engine.
7. Explain scavenging process in 2-stroke engine.

PART - C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any FOUR questions. **(4×15=60)**

1. Explain the four stages of Combustion in CI engine and draw on $p-\theta$ diagram. Indicate the duration of all four stages on diagram.
2. Explain the effect of following engine variable on Delay period on CI engine:
   a) Pressure of injection and droplet size
   b) Advance in fuel injection
   c) Compression ratio,
   d) Temperature of intake air,
   e) Air fuel ratio
3. Classify the cooling system in IC engine. Explain forced water cooling with suitable diagram.
4. Explain the air-fuel ratio requirements for different operating conditions of SI engine
5. Explain the construction and working of free piston engine

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B.Tech. VII-Sem. (Back) Examination, December - 2023
Mechanical Engineering
7ME5-12 Operations Research

Time : 3 Hours

Maximum Marks : 120
Min. Passing Marks : 42

Instructions to Candidates:

Attempt All Ten questions from Part A, Five questions out of Seven from Part B and Four questions out of Five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

PART - A

Answer should be given up to 25 words only.

All questions are Compulsory. **(10×2=20)**

1. What are the applications of Operation Research?
2. State the examples of group replacement concept.
3. Describe individual replacement policy.
4. Define Lead time and reorder point.
5. Define holding cost and ordering cost.
6. Distinguish between mathematical models and Simulation models.
7. What are the characteristics of game theory?
8. Give the Mathematical formulation of assignment problem.
9. Define Saddle point.
10. State the general linear programming problem(LPP) and put in the Standard form.

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PART-B

(Analytical/Problem Solving questions)

Attempt any Five questions. **(5×8=40)**

1. Reduce the following (2×n) game to (2×2) game by graphical method and hence solve.

		B				
		I	II	III	IV	V
A	I	2	-1	5	-2	6
	II	-2	4	-3	1	0

2. A pipe line is due for repairs. It will cost Rs.10,000 and last for 3 years. Alternatively, a new pipeline can be laid at a cost of Rs.30,000 and lasts for 10 years. Assuming cost of capital to be 10% and ignoring Salvage value, which alternative should be chosen?

3. Find the cost period of individual replacement of an installation of 300 lighting bulbs, given the following.

   i) Cost of replacing One bulb is Rs.3

   ii) Conditional probability of failure is given below:

Week number	0	1	2	3	4
Conditional probability of failure	0	$\frac{1}{10}$	$\frac{1}{3}$	$\frac{2}{3}$	0

4. In a store with one server, 10 customers arrive on an average of 6 minutes. Service is done for 12 customers in 7 minutes, find.

   i) The average number of customers in system.

   ii) The average queue length.

   iii) The average time a customer spends in the store.

   iv) The average time a customer waits before being served.

5. The cost of a new machine is Rs.50,000, The maintenance cost of n^{th} year is given by $R_n=5,000(n-1)$; n=1,2,3,.... Assuming that the money value will not change with time, after how many years will it be economical to replace the machine by new one?

6. Solve the following assignment and calculate the assignment cost

	A	B	C	D	E
A	30	39	31	38	40
B	43	37	32	35	38
C	34	41	33	41	34
D	39	36	43	32	36
E	32	49	35	40	33
F	36	42	35	44	42

7. Solve the Linear programming problem:

Max $Z = 3x_1 + 2x_2$

Subjected to $4x_1 + 3x_2 \leq 12$
$4x_1 - x_2 \leq 8$
$x_1, x_2 \geq 0$

PART - C

(Descriptive/Analytical/Problem Solving/ Design questions) **(4 × 15 = 60)**

Attempt Any Four Questions.

1. a) Write the advantages, limitations and applications of linear programming. **(8)**

   b) How do you classify the quing models? Explain. **(7)**

2. a) Derive EOQ with the assumptions involved in. **(7)**

   b) A stockist purchases an item at the rate of Rs.40 per piece from a manufacturer. 2000 units of the item are required per year. What should be the order quantity per order if the cost per order is Rs.15 and inventory charges per year are 20%? **(8)**

3. Use Big M graphical method to Solve the following: **(15)**

   Maximize $Z = 3x_1 + 2x_2 + x_3$

   Subject to $x_1 + x_2 = 7$
   $2x_1 + x_2 + x_3 \geq 10$
   $x_1, x_2, x_3 \geq 0$

4. a) Explain the advantages, disadvantages and applications of Simulation. **(10)**

   b) What are random numbers and how are they generated in simulation. **(5)**

5. a) Explain the "Competitive games" and "two person zero sum game". **(8)**

   b) Discuss the step-by-step procedure of application of principle of dominance for solving game theory problem. **(7)**

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7E7014

B.Tech. VII-Sem. (Back) Examination, January - 2024
Mechanical Engineering
7ME4A Turbomachines

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **Five** questions, selecting **One** question from **each unit**. All questions carry **Equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

UNIT - I

1. a) What are the basic laws and equations used in turbomachines? Explain.
   b) What are the various types of turbomachines? Explain with neat diagrams wherever necessary **(8+8)**

(OR)

1. Using dimensional analysis, prove that the frictional torque(T) of a disc of diameter(D) rotating at speed (N) in a fluid of viscosity(μ) and density (ρ) in a turbulent flow is given by **(16)**

$$T = D^5 N^2 \rho \, \phi \left[\frac{\mu}{D^2 N \rho} \right]$$

UNIT - II

2. 20 m^3 of air per second at 1 bar and 15°C is to be compressed in a centrifugal compressor through a pressure ratio 1.5:1.
   The compression follows the law $PV^{1.5}$= Constant
   The velocity of flow at inlet and outlet remains constant and is equal to 60 m/s.
   If the inlet and outes impeller diameters are respectively 0.6m and 1.2m and the speed of rotation is 5000 rpm. Find
   (a) The blade angles at inlet and outlet of the impeller and the angle at which the air from the impeller enters the casing.
   (b) Breadth of impeller blade at inlet and outlet.

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Assume whole pressure increase occurs in impeller and blades have a negligible thickness. **(16)**

(OR)

2. a) Derive relation for the degree of reaction of a centrifugal compressor.
   b) Draw centrifugal compressor characteristics curve and explain surging and choking phenomenon. **(8+8)**

UNIT - III

3. Draw and explain working of centrifugal pump . Derive relation for work done by Centrifugal pumps. **(16)**

(OR)

3. An axial flow pump has an impeller of outlet diameter 1.0 m. The diameter of boss is 0.5m. If the specific speed of pump is 30 and velocity of flow is 2 m/s. Suggest a suitable speed of the pump to give a head of 6m. Also determine Vane angle at the entry of the pump, if the flow is axial out inlet **(16)**

UNIT - IV

4. a) Compare Ideal and practical gas turbine cycle with neat diagram.
   b) Explain the effect of reheating and inter cooling on gas turbine cycle with neat diagram. **(8+8)**

(OR)

4. Explain the following.
   a) Turbo prop and turbojet engines.
   b) specific thrust and efficiency. **(8+8)**

UNIT - V

5. a) Differentiate impulse and reaction turbines.
   b) Draw velocity diagram of impulse turbine and derive relation for work done **(8+8)**

(OR)

5. Derive relation for stage efficiency of a reaction turbine. **(16)**
