

M. Tech. Heat Power Engineering (CBCS Pattern) Sem-II
PHPS242 / PHPS24X / PHPS24(B) - Design of I.C. Engine Components and Subsystem

P. Pages : 2

Time : Three Hours



GUG/W/22/11011

Max. Marks : 70

- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Illustrate your answers wherever necessary with the help of neat sketches.
 5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
 6. Discuss the reaction, mechanism wherever necessary.
 7. Answer **any five** questions.

1. a) Explain the variation of thermal efficiency of a diesel engine with cut off ratio at different compression ratios & adiabatic exponents. 7
b) How does the compression ratio affects the thermal efficiency of a constant volume. Full air cycle with varying equivalent ratio? Show by a suitable graph. 7
2. a) Compose with the help of $p - v$ & $T - S$ diagram the thermal efficiencies of diesel, otto & dual cycle for the some peak pressure, peak temperature & heat rejection. 5
b) A diesel engine working between 300 k & 2500 k & running at full load is to be designed for \max^m work output. Find the required compression ratio if air is used as a working fluid & cut off is maintained as $\rho = 2.5$. Also find the air standard efficiency of the engine & work done per kg of air. 5
c) Explain how the flame speed in actual cycle of S.I. Engine varies with respect to the following engine variables. 4
 - i) Air/Full ratio
 - ii) Engine speed
3. a) In a Carnot cycle the maximum pressure & temperature are limited to 18 BAR & 410°C. The ratio of isentropic compression is 6 & isothermal expansion is 1.5. Assuming the volume of the air at the beginning of isothermal expansion as 0.18m^3 . Determine: 5
 - 1) the temperature & pressure at main points in the cycle.
 - 2) change in entropy during isothermal expansion
 - 3) mean thermal efficiency of the cycle.
b) Describe with suitable sketches the combustion phenomenon in S.I. engines & explain the two phases of combustion. 5
c) What is ignition lag? Discuss the effect of engine variable on ignition lag. 4

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| 4. | a) | Why overcooling in an engine is harmful? Also explain what is evaporative cooling? | 5 |
| | b) | What is abnormal combustion of knock? How can we differentiate between normal combustion of knock & abnormal combustion of knock? | 5 |
| | c) | How pre-ignition can be detected? | 4 |
| 5. | a) | What is the necessity of gasoline injection? Explain with suitable sketch. | 5 |
| | b) | What are the various sensors used in electronic gasoline injection system? Explain any one in brief. | 5 |
| | c) | Discuss in brief full spray characteristics of CI engine. | 4 |
| 6. | a) | Discuss the effects of following engine variables on engine knock in S.I. engines. | 7 |
| | i) | Compression ratio | |
| | ii) | Turbulence | |
| | iii) | Location of spark plug | |
| | iv) | Combustion chamber shape | |
| | b) | List various electronic ignition systems in use? Describe any one of them including its advantages over the conventional ignition system. | 7 |
| 7. | a) | What are the main sources of pollutants from petrol engine. | 4 |
| | b) | Discuss the formation of No_x in the exhaust of I.C. Engine? What are the important variables that effect NOX emissions. | 6 |
| | c) | Discuss in brief with neat sketch EGR system. | 4 |
| 8. | | Discuss briefly any three . | 14 |
| | 1) | Factors considered for design of fuel injector. | |
| | 2) | Spray formation, Atomization & penetration in C.I. engine fuel injection. | |
| | 3) | Rating of IC engine fuels. | |
| | 4) | Particulates emission of IC engines. | |
