**Printed page: 03** **Subject Code: AMTME0118**

**Roll No:** | | | | | | | | | | | | | | |

**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA**

**(An Autonomous Institute Affiliated to AKTU, Lucknow)**

**MASTER OF TECHNOLOGY (M. Tech)**

**(SEM: First; Theory Examination (2020-2021)**

**SUBJECT NAME: ADVANCED I.C. ENGINES**

**Time: 3Hours** **Max. Marks:70**

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**General Instructions:**

- All questions are compulsory. Answers should be brief and to the point.
- This Question paper consists of 03 pages & …8 questions.
- It comprises of three Sections, A, B, and C. You are to attempt all the sections.
- **Section A** -Question No- 1 is objective type questions carrying 1 mark each, Question No- 2 is ver short answer type carrying 2 mark each. You are expected to answer them as directed.
- **Section B** - Question No-3 is Long answer type -I questions with external choice carrying 4marks each. You need to attempt any five out of seven questions given.
- **Section C** -Question No. 4-8 are Long answer type –II (within unit choice) questions carrying 7marks each. You need to attempt any one part *a* or*b.*
- Students are instructed to cross the blank sheets before handing over the answer sheet to the invigilator.
- No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

## SECTION – A

**1. Answer all of the following-** **[5x1=5]** **CO**

**a.** With increase temperature of intake air, the thermal efficiency of IC Engine ..... **(1)** **CO1**

- **(i)** decreases
- **(ii)** increases
- **(iii)** remains same
- **(iv)** depend on other factors

**b.** In compression ignition engines, swirl denotes a ..... **(1)** **CO2**

- **(i)** Haphazard motion of the gases in the chamber
- **(ii)** Rotary motion of the gases in the chamber
- **(iii)** Radial motion of the gases in the chamber
- **(iv)** None of the above

**c.** In most automobiles, which lubrication system is commonly used? **(1)** **CO3**

- **(i)** Splash system
- **(ii)** Pressure system
- **(iii)** Petrol system
- **(iv)** Gravity system

**d.** Which of the following fuels can be obtained by fermentation of vegetable matter? **(1)** **CO4**

- **(i)** Gasoline
- **(ii)** Diesel
- **(iii)** Alcohol
- **(iv)** Biodiesel

**e.** The effective inhibitor of pre-ignition is ..... **(1)** **CO5**

- **(i)** Alcohol
- **(ii)** Water
- **(iii)** Lead
- **(iv)** None of these

**2. Answer all of the following- [5×2=10] CO**

| | | | |
|---|---|---|---|
| **a.** | List the different operating conditions of an automobile SI engine. | **(2)** | **CO1** |
| **b.** | What is the effect of delay period on Knock in CI engines? | **(2)** | **CO2** |
| **c.** | State the purpose of turbo chargers in automotive engines. List any 4 type of turbo charger in CI engines? | **(2)** | **CO3** |
| **d.** | Give the major pollutants that are to be controlled in automobile engines. State usage of Ringelmann chart. | **(2)** | **CO4** |
| **e.** | What is the principle of operation of a stratified charge engine? | **(2)** | **CO5** |

## SECTION – B

**3. Answer any five of the following- [5x4=20]**

| | | | |
|---|---|---|---|
| **a.** | What do you understand by thermodynamics analysis of IC engine combustion process? Explain in detail giving a governing equations. | **(4)** | **CO1** |
| **b.** | Explain the various factors that affect knock in SI engines. Discuss the different types of combustion chamber employed in SI engine. | **(4)** | **CO2** |
| **c.** | What is delay period & what are the factors that affect the delay period? | **(4)** | **CO2** |
| **d.** | Explain the merits and demerits of air and water cooling system. | **(4)** | **CO3** |
| **e.** | What are emission norms? With suitable sketches explain the working principle of NDIR analyser and frame ignition detector (FID)? | **(4)** | **CO4** |
| **f.** | Explain the performance combustion and emission characteristics of CI engine used Bio diesel as a fuel? | **(4)** | **CO4** |
| **g.** | Discuss about the HCCI engine. Briefly describe the performance of surface ignition engine | **(4)** | **CO5** |

## SECTION – C

**4 Answer any one of the following- [5×7=35] CO**

**a.** The compression ratio for a single-cylinder engine operating on a dual cycle is 9. The maximum pressure in the cylinder is limited to 60 bar. The pressure and temperature of the air at beginning of the cycle are 1 bar and 30°C. Heat is added during constant pressure process upto 4 percent of the stroke. Assuming the cylinder diameter and stroke length as 250 mm and 300 mm respectively, determine: **(7) CO1**

- **(i)** The air standard efficiency of the cycle.
- **(ii)** The power developed if the number of working cycles are 3 per second.

Take for air $C_v$ = 0.71 kJ/kgK and $C_p$ = 1.0 kJ/kgK

**b.** A 4- cylinder, 4-stroke petrol engine having 90 mm bore and 130 mm stroke develops 30 kW of power while running at 1500 r.p.m and using a 20% rich mixture. The theoretical air-fuel ratio is 15:1. Calorific value of petrol is 46000 kJ/ kg. Volumetric efficiency measured at 15°C and 760 mm of mercury as standard temperature and pressure is 70% and mechanical efficiency is 90%. **(7) CO1**

Find:

- **(i)** Indicated Thermal efficiency
- **(ii)** Brake mean effective pressure
- **(iii)** Brake Thermal efficiency

**5. Answer any <u>one</u> of the following-**

| | | | |
|---|---|---|---|
| **a.** | Using pressure crank angle diagram explain different stages of combustion observed in a typical CI engine. Why is undesirable to have a fourth phase of combustion (combustion during late expansion stroke)? | **(7)** | **CO2** |
| **b.** | Discuss in details about the various stages of combustion in a SI engine. What are the various factors that influence the flame speed of SI engine? Explain in detail. | **(7)** | **CO2** |

**6. Answer any <u>one</u> of the following-**

| | | | |
|---|---|---|---|
| **a.** | Discuss the method of obtaining in the rate of heat release from engines. | **(7)** | **CO3** |
| **b.** | What do you understand by turbo charging? Why SI engines are not usually turbo charged. Give the boost pressure range for SI & CI engines. | **(7)** | **CO3** |

**7. Answer any <u>one</u> of the following-**

| | | | |
|---|---|---|---|
| **a.** | Give a table describing in detail the comparison between alcohol, hydrogen natural gas, LPG and vegetables oils for their suitability as IC engine fuel. Consider all important Factors pertinent to engine combustion? | **(7)** | **CO4** |
| **b.** | What are the modification to be made in CI engine running on biodiesel? Explain in detail about the use of the biodiesel as fuel in CI engine and various merits and demerits of it use? | **(7)** | **CO4** |

**8. Answer any <u>one</u> of the following-**

| | | | |
|---|---|---|---|
| **a.** | Using a neat layout diagram explain gasoline direct injection (GDI) system. Explain the type of sensor used for measurement of air mass flow, temperature, speed and pressure. | **(7)** | **CO5** |
| **b.** | What is fuel cell? Explain main benefits of hydrogen fuel cells. | **(7)** | **CO5** |