

Code: 4G542

II B.Tech. II Semester Supplementary Examinations March 2021

Applied Thermodynamics - I

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

| | | Marks | CO | BL |
|-----------------|--|-------|----|----|
| UNIT-I | | | | |
| 1. | a) With P-V and T-S diagrams Explain different processes of a Stirling Cycle | 8M | 1 | 3 |
| | b) Define and explain about: (i) Mean Effective Pressure (ii) Compression Ratio (iii) Time Loss Factor | 6M | 1 | 1 |
| OR | | | | |
| 2. | a) Derive an expression for Mean effective pressure of a Dual Cycle | 10M | 1 | 3 |
| | b) What will be effect on efficiency of an Otto cycle having a compression ratio of 8, if C_v increases by 1.6 % | 4M | 1 | 3 |
| UNIT-II | | | | |
| 3. | a) Explain with neat sketches valve timing diagram of a four stroke single cylinder diesel engine | 7M | 2 | 3 |
| | b) With a neat sketch explain the Fuel injection system used in CI engines | 7M | 2 | 2 |
| OR | | | | |
| 4. | a) Discuss the constructional features of Forced Circulation system and Lubrication | 7M | 2 | 2 |
| | b) Describe in detail the working principle and constructional features of Battery Ignition System. | 7M | 2 | 2 |
| UNIT-III | | | | |
| 5. | a) With neat sketches classify types of combustion chambers used for SI engines | 7M | 3 | 2 |
| | b) Describe the phenomenon knocking in SI engines and compare it with CI engines | 7M | 3 | 3 |
| OR | | | | |
| 6. | a) Discuss the combustion process in CI engines with neat sketch | 7M | 3 | 3 |
| | b) Classify types of fuels used for an IC engines. | 7M | 3 | 2 |
| UNIT-IV | | | | |
| 7. | a) What is heat Balance Test? Explain its significance | 6M | 4 | 2 |
| | b) A four stroke petrol engine delivers BP of 36.8 kW with a mechanical efficiency of 80%. The A/F ratio is 15:1 and fuel consumption is 0.4068kg/kWhr. The heating value of the fuel is 42000 kJ/kg. Calculate IP, FP, η_{th} , η_{ith} , total fuel consumption and air consumption per second. | 8M | 4 | 3 |
| OR | | | | |
| 8. | a) Discuss Morse test method to measure Friction Power of an IC engine | 6M | 4 | 2 |
| | b) The power output of a 6 cylinder is absorbed by water brake for which the law is $\frac{WN}{20000}$ where the brake load W is in N, Speed N is in rpm. The air consumption is measured by an air box with sharp edged orifice system. The following are obtained: orifice diameter = 30 mm, Bore = 100 mm, Length of stroke = 120 mm, Load W = 560 N, $\frac{C}{H} = \frac{92}{17}$, Coefficient of discharge = 0.6, Ambient pressure = 1 bar, pressure drop across orifice=14.5 mm of Hg, time taken for 100 cc of fuel consumption = 20 sec, ambient temperature = 27°C, fuel density = 831 kg/m ³ . Calculate (i) Brake Power, (ii) Torque, (iii) BSFC, (iv) % of excess air, (v) volumetric efficiency. | 8M | 4 | 3 |
| UNIT-V | | | | |
| 9. | a) Classify types of compressors | 4M | 5 | 2 |
| | b) A single acting single cylinder reciprocating air compressor has a cylinder diameter of 300 mm and a stroke of 400 mm. It runs at 175 rpm, air enters the cylinder at 1.0136 bar, 23°C. It is then compressed to 7 bar. Calculate the mean effective pressure and indicated power input to compressor when the compression process is (i) isothermal (ii) according to the law $PV^{1.25}=\text{constant}$ (iii) adiabatic. Calculate the isothermal efficiency for each case. Neglect the clearance volume. | 10M | 5 | 3 |
| OR | | | | |
| 10. | a) Compare Reciprocating and Rotary air compressors | 4M | 5 | 2 |
| | b) Define the volumetric efficiency of compressor and prove that $\eta_{vol} = 1 + c - c \left(\frac{P_2}{P_1} \right)^{1/\eta^e}$ | 10M | 5 | 3 |

Code: 4GC42

II B.Tech. II Semester Supplementary Examinations March 2021

Probability and Statistics

(Common to CE, ME & IT)

Max. Marks: 70

Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

Marks

UNIT-I

1. a) In a bolt factory machine A, B, C manufacture 20%, 30% and 50% of the total of their output and 6%, 3%, and 2% are defective. A bolt is drawn at random and found to be defective. Find the probability that it is manufactured from (i) Machine A (ii) Machine B (iii) Machine C 7M

- b) A random variable X has the following probability distribution :

| | | | | | | | | |
|------|---|---|----|----|----|----------------|-----------------|--------------------|
| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| P(x) | 0 | K | 2K | 2K | 3K | K ² | 2K ² | 7K ² +K |

Determine (i) K (ii) P(x<6) (iii) E[x²] 7M

OR

2. a) The probability density $f(x)$ of a continuous random variable is given by $f(x) = c e^{-|x|}$, $-\infty < x < \infty$. Find the value of c, mean and variance of the distribution. 7M
- b) Bag I contains 4 white and 6 black balls while another Bag II contains 4 white and 3 black balls. One ball is drawn at random from one of the bags and it is found to be black. Find the probability that it was drawn from Bag I. 7M

UNIT-II

3. a) The probability that the bulb of 100 days life is 0.05. Find the probability that one of 6 bulbs (i) At least one (ii) greater than four (iii) none, will be having a life of 100 days. 7M
- b) If a random variable has a Poisson distribution such that $P(1)=P(2)$, find (i) mean of the distribution (ii) P(4) (iii) P(x ≥ 1) (iv) P(1<x<4) 7M

OR

4. a) The mean weight of 500 college students is 70 kg and the standard deviation is 3 kg. Assuming that the weight is normally distributed, determine how many students weigh: (i) between 70 kg and 75 kg. (ii) more than 80 kg. (iii) less than 64 kg. 7M
- b) The following data was collected over a period of 10 years, showing the number of injuries from horse kicks in each of the 200 army corps. The distribution of injuries was as follows:

| | | | | | | |
|-----------------|-----|----|----|---|---|-------|
| No. of injuries | 0 | 1 | 2 | 3 | 4 | Total |
| Frequency | 109 | 65 | 22 | 3 | 1 | 200 |

Fit a Poisson distribution to the data and calculate the theoretical frequencies: 7M

UNIT-III

5. a) Traveling between two campuses of a university in a city via shuttle bus takes, on average, 28 minutes with a standard deviation of 5 minutes. In a given week, a bus transported passengers 40 times. What is the probability that the average transport time, i.e., the average for 40 trips, was more than 30 minutes? Assume the mean time is measured to the nearest minute. 7M
- b) The contents of seven similar containers of sulfuric acid are 9.8, 10.2, 10.4, 9.8, 10.0, 10.2, and 9.6 liters. Find a 95% confidence interval for the mean contents of all such containers, assuming an approximately normal distribution. 7M

OR

6. a) A population consists of the four numbers 3, 7, 11, 15. Consider all possible samples of size 2 which can be drawn with replacement from this population. Find the population mean and standard deviation, and mean and standard deviation of the sampling distribution of means. 7M
- b) Find 95% confidence limits for the mean of a normality distributed population from which the following sample was taken 15,17,10,18,16,9,7,11,13,14. 7M

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| UNIT-IV |
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7. a) Before an increase in excise duty on tea, 800 people out of a sample of 1000 were consumers of tea. After the increase in duty, 800 people were consumers of tea in a sample of 1200 persons. Find whether there is significant decrease in the consumption of tea after increase in duty? 7M
- b) Explain the following
 1) Null hypothesis 2) Critical region 3) Type I and Type II errors. 7M

OR

8. a) In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant at 0.05 level of significance? 7M
- b) The following are the samples of skills. Test the significant difference between the means at 0.05 level

| | | | | | | |
|-----------|------|------|------|------|------|------|
| Sample I | 71.4 | 77.7 | 74.4 | 74 | 73.8 | - |
| Sample II | 70.8 | 74.9 | 74.2 | 70.4 | 69.2 | 72.2 |

7M

| |
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| UNIT-V |
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9. a) The theory predicts the proportion of beans, in the four groups: A, B, C and D should be 9:3:3:1. In an experiment with 1600 beans the number in the four groups were 882, 313, 287 and 113. Does the experiment result support the theory. 7M
- b) Two random samples drawn from two normal populations have the variable values as below:

| | | | | | | | |
|---------|----|----|----|----|----|----|----|
| Sample1 | 28 | 30 | 32 | 33 | 31 | 29 | 34 |
| Sample2 | 29 | 30 | 30 | 24 | 27 | 28 | |

Examine whether the samples have been drawn from a normal population having the same variance. 7M

OR

10. a) A sample of size 13 gave an estimated population variance of 3.0 while another sample of size 15 gave an estimate of 2.5. Could both samples be from population with same variance? 7M
- b) In a pre-poll survey out of 1000 urban voters 540 favoured B and the rest A. Out of 1000 rural voters, 620 favoured A and the rest B. Examine if the nature of the area is related to voting performance using the Chi-square test. 7M
