

Code: 5G541

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: 5G245

II B.Tech. II Semester Supplementary Examinations March 2021

Electrical and Electronics Engineering

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

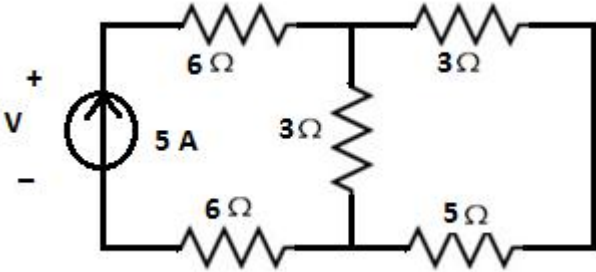
Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

Marks CO Blooms Level

UNIT-I

1. a) Define
 (i) Active & Passive elements
 (ii) Linear and nonlinear elements with examples.
- b) In the circuit shown in figure 1, determine 'V'

6M CO1 L2



8M CO1 L3

OR

2. a) State and explain Kirchhoff's laws with example.
- b) Explain the equations for resistors in equivalent delta, if the resistors Ra, Rb and Rc are connected electrically in star?

6M CO1 L1

8M CO1 L2

UNIT-II

3. a) Derive the equation for induced EMF of a DC generator?
- b) Explain the different types of DC generators with necessary equations

6M CO2 L5

8M CO2 L4

OR

4. a) Explain the principle of operation of DC motor
- b) A 220 V d.c shunt motor has armature and field resistance as 0.8 and 200 . During Swinburne's test, current drawn from the supply is found to be 2.5 A. Estimate the efficiency of the machine, when it is running as a motor drawing a line current of 40 A from the 220 V supply.

6M CO2 L2

8M CO2 L3

UNIT-III

5. a) Explain the principle of operation of single phase Transformer
- b) In a 10 KVA, 1000/100 V single phase transformer, the iron and full load copper losses are 150W and 200W respectively. Calculate the efficiency at unity power factor on full load and half the full load.

6M CO3 L2

8M CO3 L3

OR

6. a) Explain how to find the efficiency of three phase induction motor by conducting Brake test.
- b) Explain the principle of operation of Alternator.

8M CO3 L4

6M CO3 L5

UNIT-IV

7. a) Draw and explain the V-I characteristics of a PN junction diode. 6M CO4 L2
b) With neat sketch explain full wave rectifier and also derive the expression for the average output voltage. 8M CO4 L4

OR

8. a) What are the advantages of CE configuration compared to CC and CB Configuration 6M CO4 L1
b) Draw and explain the input and output characteristics of a transistor in Common Emitter configuration. 8M CO4 L4

UNIT-V

9. a) What is electric heating and what are its advantages over other methods of heating. 6M CO5 L1
b) Explain the working principle of Induction heating and write its applications. 8M CO5 L2

OR

10. a) Explain the block diagram of CRO with neat sketch. 8M CO5 L2
b) Explain about the frequency measurement using CRO. 6M CO5 L4

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R-15

Code: 5G542

II B.Tech. II Semester Supplementary Examinations March 2021

Fluid Mechanics and Hydraulic Machinery

(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	Blooms Level
UNIT-I			
1. a) Determine the intensity of shear of an oil having viscosity of 1 poise. The oil is used for lubricating the clearance between a shaft of diameter 10cm. and its journal bearing. The clearance is 1.5mm and the shaft rotates at 150r.p.m.	8M	1	2, 3, 4
b) Explain atmospheric, absolute and gauge pressures. Give the relationship between the pressures.	6M	1	2
OR			
2. a) Explain the classification of fluid flow in detail.	8M	1	2
b) Explain the following: (i) Stream line, (ii) Path line and (iii) Streak line.	6M	1	2, 3
UNIT-II			
3. a) Name the different forces present in a fluid flow. For the Euler's equation of motion, which forces are taken into consideration?	4M	2	1
b) A 45° reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600 mm and 300 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm ² and the rate of flow of water is 600 litres/s.	10M	2	2, 3, 4
OR			
4. a) Define and explain the terms: (i) Hydraulic gradient line and (ii) Total energy line.	6M	2	1, 2
b) A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of water. The pressure at inlet is 17.658N/cm ² and the vacuum pressure at the throat is 30cm of mercury. Find the discharge of water through the venturimeter. Take C _d =0.98.	8M	2	2, 3, 4
UNIT-III			
5. a) With a neat sketch, explain the various elements of a hydropower plant.	8M	3	2, 3
b) What is a pumped storage plant? Explain.	6M	3	2, 3
OR			
6. a) Obtain an expression for the force exerted by a jet of water on an inclined fixed plate in the direction of the jet.	4M	3	2, 3
b) A jet of water having a velocity of 15m/s strikes a curved vane which is moving with a velocity of 5m/s. The vane is symmetrical and is so shaped that the jet is deflected through 120°. Find the angle of the jet at inlet of the vane so that there is no shock. What is the absolute velocity of the jet at outlet in magnitude and direction and the work done per unit weight of water? Assume the vane to be smooth.	10M	3	2, 3, 4

UNIT-IV

7. a) A Pelton wheel has a mean bucket speed of 35m/s with a jet of water flowing at the rate of $1\text{m}^3/\text{s}$ under a head of 270 m. The buckets deflect the jet through an angle of 170° . Calculate the power delivered to the runner and the hydraulic efficiency of the turbine. Assume Co-efficient of velocity as 0.98. 2, 3, 7M 4 4
- b) What is a draft-tube? What are the uses of a draft-tube? Describe with neat sketches two different types of draft-tubes. 1, 2, 7M 4 3

OR

8. a) A turbine develops 9000 kW when running at 100 r.p.m. The head on the turbine is 30m. If the head on the turbine is reduced to 18m, determine the speed and power developed by the turbine. 2, 3, 5M 4 4
- b) Define the unit quantities for a turbine. Derive expressions for the unit quantities of a turbine. 9M 4 1, 2

UNIT-V

9. a) A centrifugal pump delivers water against a net head of 14.5m and a design speed of 1000 r.p.m. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300mm and outlet width is 50mm. Determine the discharge of the pump if manometric efficiency is 95%. 2, 3, 8M 5 4
- b) Define the specific speed of a centrifugal pump. Derive an expression for the specific speed of a centrifugal pump. 6M 5 1, 2

OR

10. a) A double-acting reciprocating pump, running at 40 r.p.m., is discharging 1m^3 of water per minute. The pump has a stroke of 400 mm. The diameter of the piston is 200 mm. The delivery and suction heads are 20m and 5m respectively. Find the slip of the pump and power required to drive the pump. 2, 3, 7M 5 4
- b) Define indicator diagram of a reciprocating pump. Draw an indicator diagram and explain. 1, 2, 7M 5 3

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R-15

Code: 5G543

II B.Tech. II Semester Supplementary Examinations March 2021

Kinematics of Machinery

(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	Blooms Level
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UNIT-I

- | | | | | |
|----|--|----|-----|----|
| 1. | a) Classify and explain various kinematic pairs. | 6M | CO1 | L2 |
| | b) Sketch and explain any two inversions of four bar chain | 8M | CO1 | L2 |

OR

- | | | | | |
|----|--|----|-----|----|
| 2. | a) Sketch and explain slotted lever quick return mechanism. | 8M | CO1 | L2 |
| | b) In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm. Find the (i) inclination of the slotted bar with vertical in the extreme position (ii) the time ratio of cutting stroke to the return stroke (iii) Length of the stroke. Length of the slotted lever is 450 mm. | 6M | CO1 | L3 |

UNIT-II

- | | | | | |
|----|--|-----|-----|----|
| 3. | In a slider crank mechanism, the crank OB is 30 mm and the connecting rod BC is 120 mm long. The crank rotates at 300 rpm clockwise and makes 60° from IDC. Find | | | |
| | i) The velocity of piston C. | | | |
| | ii) Angular velocity of connecting rod BC. | 14M | CO2 | L3 |

OR

- | | | | | |
|----|---|-----|-----|----|
| 4. | A link AB of a four bar ABCD revolves uniformly at 120 rpm in a clock wise direction. Find the angular acceleration of the links BC and CD and acceleration of point E on link BC. Take AB=75mm; BC=175mm; EC=50mm; CD=150mm; DA=100mm and angle BAD=90°. | 14M | CO2 | L3 |
|----|---|-----|-----|----|

UNIT-III

- | | | | | |
|----|--|-----|-----|----|
| 5. | Sketch and explain Peaucellier straight-line mechanism. Prove that it generates exact straight line. | 14M | CO3 | L2 |
|----|--|-----|-----|----|

OR

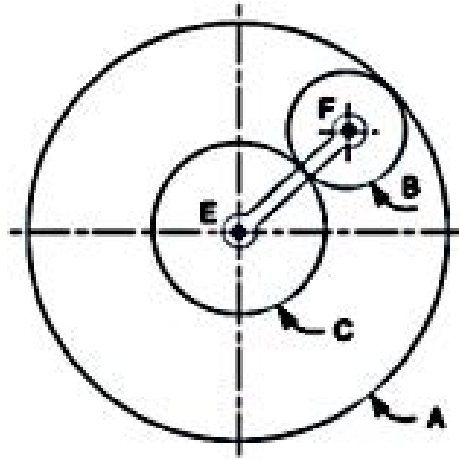
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|----|--|----|-----|----|
| 6. | a) In a Davis steering gear, the distance between the pivots of the front axle is 1m and the wheel base is 2.5m. Find the inclination the track arm to the longitudinal axis of the car, when it is moving along a straight line. | 7M | CO3 | L3 |
| | b) Two shafts are connected by a Hooke's joint. The driving shafts revolve uniformly at 500 rpm. If the total permissible variation on speed of the driven shaft is not exceeded ± 6% of the speed, find the greatest permissible angle between the centre lines of the shafts. Also determine the maximum and minimum speeds of the driven shaft. | 7M | CO3 | L3 |

UNIT-IV

- | | | | | |
|----|---|-----|-----|----|
| 7. | A pair of gears, having 40 and 30 teeth respectively is of 25° involute form. The addendum length is 5mm and module pitch is 2.5 mm. If the smaller wheel is the driver and rotates at 1500 rpm, find the velocity of sliding at the point of engagement and at the point of disengagement. | 14M | CO4 | L3 |
|----|---|-----|-----|----|

OR

8. An epi-cyclic gear train consists of three gears A, B and C as shown in figure. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 rpm. If gear A is fixed, determine the speed of gears B and C.



14M CO4 L3

UNIT-V

9. Draw the profile of a cam operating a knife edge follower from the following data:
- Follower to move outward through 40 mm during 60° of a cam rotation,
 - Follower to dwell for the next 45°
 - Follower to return its original position during next 90°
 - Follower to dwell for the rest of the cam rotation.

The displacement of the follower is to take place with SHM during both outward and return strokes. The least radius of the cam is 50mm. If the rotates at 300 rpm, determine the maximum velocity and acceleration of the follower during the outward stroke and return stroke.

14M CO5 L3

OR

10. Draw the profile of a cam for the following data in which the roller follower moves with uniform acceleration and retardation motion during ascent and descent.

Minimum radius of cam	= 25mm
Roller radius	= 8mm
Lift	= 32mm
Offset of follower axis	= 12mm towards right
Angle of ascent	= 60°
Angle of descent	= 90°
Angle of dwell between ascent and descent	= 45°
Speed	= 200rpm

14M CO5 L3

Code: 5GC42

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

UNIT-IV

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

UNIT-V

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
