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B. Tech. 6th Semester (ME) (Elective - I) Examination – May, 2023

INTERNAL COMBUSTION ENGINES & GAS TURBINES

Paper : PEC-ME-320-G

Time : Three Hours]　　　　　　　　[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) What are the various assumptions made in various air standard cycle ?

   (b) What are the various factors that reduce the possibility of knocking ?

   (c) Discuss application of Gas Turbine.

   (d) What are various type of ignition system ?

   (e) Define surging and choking.

   (f) What do you mean by BHP and IHP ?　$2.5 \times 6 = 15$

UNIT – I

2. Explain the various air standard cycles like otto, diesel and dual combustion cycles with assumption.   15

3. With the help of a neat sketch explain the working principle of a simple carburetor.   15

UNIT – II

4. What is lubrication? Mention different types of lubrication system. Explain wet sump lubrication system with the help of a neat sketch.   15

5. What is meant by abnormal combustion? Explain the phenomenon of knock in CI Engine and compare the same with SI Engine Knock.   15

UNIT – III

6. A four stroke petrol engine delivers 35 KW with a mechanical efficiency of 80%. The fuel consumption of the engine is 0.4 kg per KW-hr and the air-fuel ratio is 14 : 1. The heating value of the fuel is 43000 kj/kg. Find (a) the indicated power, (b) the friction power, (c) the brake thermal efficiency, (d) the fuel consumption per hour and (e) the air consumption per hour.   15

7. Describe the various methods of emission control.   15

UNIT – IV

8. What are compressors ? Explain rotary and centrifugal compressors.   15

9. Explain the methods that can adopted for improvement of the basic gas turbine cycle.   15

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B. Tech. 6th Semester (ME)
Examination – May, 2023

DYNAMICS OF MACHINES

Paper : PCC-ME-308-G

Time : Three Hours]   [Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Explain the following :

   (a) Difference between flywheel and governor   5

   (b) Gyroscopic stabilization   5

   (c) Engine shaking forces   5

UNIT – I

2. What do you understand by the static and dynamic force analysis ? Explain static force analysis of planer mechanism in detail by taking some suitable example.

       15

P. T. O.

3. Derive an expression for the force acting on the crank by the connecting rod in case of a reciprocating engine.

15

UNIT – II

4. Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.

15

5. Explain the 'direct and reverse crank' method for determining unbalanced forces in radial engines. 15

UNIT – III

6. Explain Gravity controlled and spring controlled governor in detail.

15

7. What do you understand by dynamometer ? Explain the different types with labelled diagram.

15

UNIT – IV

8. Explain the application of gyroscopic principles to aircrafts.

    15

9. Derive expressions for stability of four-wheel and two-wheel vehicle moving on curved path.

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B. Tech. 6th Semester (ME) Examination – May, 2023

HEAT TRANSFER

Paper : PCC-ME-306-G

Time : Three Hours] [Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. **1** is *compulsory*. All questions carry equal marks.

1. Describe the following : 2.5 × 6 = 15

   (a) Modes of heat transfer

   (b) Efficiency of fin

   (c) Unsteady heat conduction

   (d) Types of heat exchanger

   (e) Nussult number

   (f) Film condensation

UNIT – I

2. Derive an Expression for 3-D heat conduction equation in Cylindrical coordinate system. 15

3. A furnace wall consists of three layers. The inner layer of 10 cm thickness is made of firebrick (k = 1.04 W/mK). The intermediate layer of 25 cm thickness is made of masonry brick (k = 0.69 W/mK) followed by a 5 cm thick concrete wall (k = 1.37 W/mK). When the furnace is in continuous operation the inner surface of the furnace is at 800°C while the outer concrete surface is at 50°C. Calculate the rate of heat loss per unit area of the wall, the temperature at the interface of the firebrick and masonry brick and the temperature at the interface of the masonry brick and concrete. 15

UNIT – II

4. A long rod is exposed to air at 298°C. It is heated at one end. At steady state conditions, the temperature at two points along the rod separated by 120 mm are found to be 130°C and 110°C respectively. The diameter of the rod is 25 mm OD and its thermal conductivity is 116 W/m°C. Calculate the heat transfer coefficient at the surface of the rod and also the heat transfer rate. 15

5. During a heat treatment proess, alloy steel spherical balls of 12 mm diameter are initially heated to 800°C in a furnace. Subsequently there are cooled to 100°C by keeping them immerged in an oil bath 35°C with convection coefficient 20 W/m²-K. Determine the time required for the cooling process. Proceed to calculate the value of convection coefficient if it is desired to complete the cooling process in a period of 10 minute. The physical properties of steel balls are : density 7750 Kg/m³ ; specific heat 520 J/kg-K and conductivity 50 W/m-K.   15

UNIT – III

6. Using the definition of radiosity and irradiation prove that the radiation heat exchange between two grey bodies.   15

7. Explain for fluid flow along a flat plate :   7.5 × 2 = 15

   (a) Velocity distribution in hydrodynamic boundary layer

   (b) Temperature distribution in thermal boundary layer

UNIT – IV

8. Hot exhaust gases which enters a finned tube cross flow heat exchanger at 300°C and leave at 100°C, are used to heat pressurized water at a flow rate of 1 kg/s

from 35 to 125°C. The exhaust gas specific heat is approximately 1000 J/kg.K, and the overall heat transfer co-efficient based on the gas side surface area is U_h = 100 W/m²K. Determine the required gas side surface area A using the NTU method. 15

Take Cp_c at Tc = 80°C is 4197 J/kg.K and Cp_h = 1000 J/kg.K

9. Define effectiveness of a heat exchanger. Derive an expression for the effectiveness of counter flow heat exchanger. State the assumptions made. 15

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B. Tech. 6th Semester (ME) Examination – May, 2023

DESIGN OF MACHINE ELEMENT - I

Paper : PCC-ME-304-G

Time : Three Hours]   *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

Use of following Design Data book is permitted :
(i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan (ii) Design Data Book PSG College of Technology Coimbatore.

1. Answer any 6 out of 7 :

   (a) What is technical feasibility ? Explain.   2.5

   (b) What is the belt slip and creep ?   2.5

   (c) Describe the function of key.   2.5

   (d) Write the application of chain drives.   2.5

P. T. O.

(e) Name a few automatic clutches.

(f) What is power screws ?   2.5

(g) Derive self-locking condition of brake.   2.5

                                              2.5

UNIT – I

2. (a) Define "Interchangeability" and discuss its importance.

                                              5

(b) What do you understand by stress concentration ? Define and differentiate between from stress factor and stress concentration factor.

                                              10

3. (a) Explain the factor to be considered for selection of material for a machine component.

                                              7.5

(b) Write the classification of Engineering Materials.

                                              7.5

UNIT – II

4. Design a double riveted butt joint with two cover plates for the longitudinal steam of a boiler shell, 0.70 m diameter to carry a maximum steam pressure of 1.05 N/mm². The allowable stress are $f_t = 35$ N/mm², $f_s = 28$ N/mm². Assume the efficiency of the joint 80%.

                                              15

5. Two steel rods of equal diameter are required to join with a cotter joint. Each rod is subjected to an axial tensile force of 60 KN. Design and draw the joint specifying its main dimensions.

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UNIT – III

6. Design a clamp coupling to transmit 30 kWat 100 rpm. The allowable shear stress for the shaft and key is 40 MPa and the for bolts is 70 MPa. The coefficient of friction between muff and the shaft surface may be taken as 0.3.   15

7. Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90kW at 250 rpm. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 1 degree in a length of 20 diameters. The allowable shear stress in the coupling bolts in 30 MPa.   15

UNIT – IV

8. (a) Why a positive clutch is used ? Describe, with the help of a neat sketch, the working of a jaw or claw clutch.   5

   (b) A multi-disc clutch has three discs on the driving shaft and two on the driven shaft. The inside diameter of the contact surface is 120 mm. The maximum pressure between the surface is limited to 0.1 N/mm². Design the clutch for transmitting 25 kW at 1575 r.p.m. Assume uniform wear condition and coefficient of friction as 0.3.   10
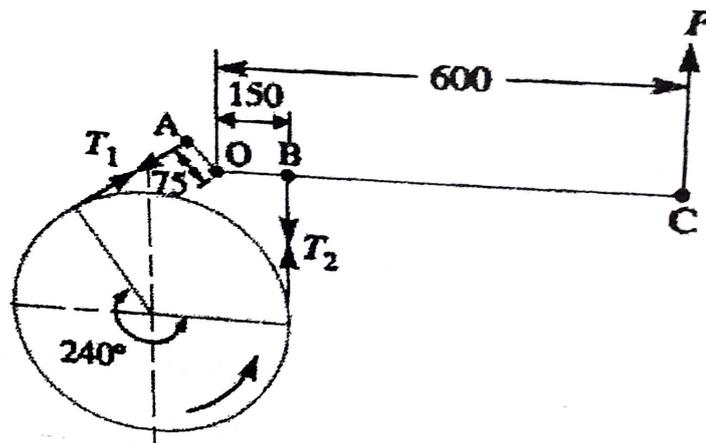
P. T. O.

9. A differential band brake, as shown in Fig. has a drum diameter of 600 mm and the angle of contact is 240°. The brake band is 5 mm thick and 100 mm wide. The coefficient of friction between the band and the drum is 0.3. If the band is subjected to a stress of 50 MPa, find :

15

(i) The least force required at the end of a 600 mm lever, and

(ii) The torque applied to the brake drum shaft.

All dimensions in mm.

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B. Tech. 6th Semester (ME) Examination – May, 2023

MANUFACTURING TECHNOLOGY - II

Paper : PCC-ME-302-G

Time : Three Hours]   [Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Explain the following :

   (a) Name the essential features of a milling fixture. 2.5

   (b) Explain the nomenclature of single point cutting tool.   2.5

   (c) What are the limitations of ECM process ?   2.5

   (d) State the advantages of NC machines.   2.5

   (e) Define built-up edge in metal cutting.   2.5

   (f) What is part family ?   2.5

UNIT – I

2. Compare orthogonal cutting and oblique cutting with its neat sketches. Explain Shear zone in metal cutting.

15

3. In an orthogonal cutting operation, the following data have been observed :

Uncut chip thickness t_1 = 0.127 mm, Width of cut b = 6.35 mm, Cutting speed V = 2 m/s, Rake angle α = 10°, Cutting force F_c = 567 N, Thrust force F_t = 227 N, Chip thickness t_2 = 0.228 mm.

Calculate shear angle, the friction angle, shear stress along the shear plane and the power for cutting operation and chip velocity.

15

UNIT – II

4. Explain working Principle of EDM process with neat sketch. Also discuss the required characteristics of tool material for EDM process.

15

5. Discuss advantages of 3-2-1 locating principle. Classify the various locating devices.

15

UNIT – III

6. Explain the components of CNC system with neat sketch. Compare the NC and CNC machine.

15

7. Explain manual part programming. Develop and explain a part program, using G and M code, for turning operation.

15

UNIT – IV

8. Explain in detail production flow analysis method. What are the advantages and hurdles in implementation of group technology ?

15

9. Explain part family in Group Technology. Discuss all the methods of grouping parts into part families.   15

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