

5E1718

Roll No. _____

Total No. of Pages: 2

5E1718

B. Tech. V - Sem. (Main) Exam., February - 2023

Automobile Engineering

5AE3 – 01 Mechatronic Systems

AE, ME

Time: 3 Hours

Maximum Marks: 70

*Instructions to Candidates:**Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.**Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.**Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*1. NIL2. NIL**PART – A****(Answer should be given up to 25 words only)****[10×2=20]****All questions are compulsory**

- Q.1 What do you mean by Mechatronic systems?
- Q.2 What are the basic functions of control system?
- Q.3 Differentiate between LTV and LTI systems.
- Q.4 Explain the dynamic response briefly.
- Q.5 Write the selection criteria for sensors.
- Q.6 Why PLCs are preferred to use over microcontrollers in industries?
- Q.7 How do we analyze the stability using root locus method?
- Q.8 Which displacement sensor has the slowest response time?
- Q.9 Why brushes are not used in BLDC?
- Q.10 What are the types of PLC programming languages?

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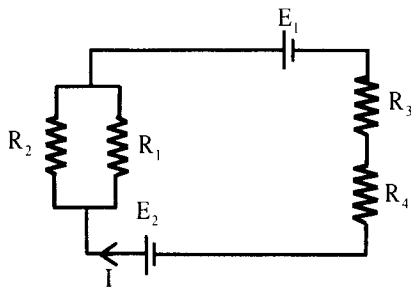
PART – B

(Analytical/Problem solving questions)

[5×4=20]

Attempt any five questions

- Q.1 Discuss the benefits of Mechatronic in manufacturing.
- Q.2 An electric circuit consists of four resistors, $R_1 = 12 \text{ Ohm}$, $R_2 = 12 \text{ Ohm}$, $R_3 = 3 \text{ Ohm}$ and $R_4 = 6 \text{ Ohm}$, and are connected with a source of e.m.f. $E_1 = 6 \text{ Volt}$, $E_2 = 12 \text{ Volt}$. Determine the electric current flows in the circuit as shown in the figure below -



- Q.3 Differentiate between hydraulic and pneumatic actuators.
- Q.4 Explain the construction and working of Bipolar Junction Transistor.
- Q.5 Discuss the effect of feedback of closed loop control system.
- Q.6 What is need of modeling in mechatronic system? Comment on the modelling of electromechanical systems.
- Q.7 What are the basic operational steps in PLC programming? Draw the physical structure of PLC.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

[3×10=30]

Attempt any three questions

- Q.1 Differentiate between sensors and actuators with the help of suitable examples. Explain various temperature sensors used and comment on their sensitivity and linearity.
- Q.2 Explain the modelling of one and two degrees of freedom systems. Clearly write the steps in modelling.
- Q.3 What are the different components of a microcontroller? Explain each one.
- Q.4 Discuss the application of PLC for real time industrial automation systems.
- Q.5 Explain the design of pick and place robot with the help of a case study.

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5E1321

Roll No. _____

Total No. of Pages: **2****5E1321****B. Tech. V - Sem. (Back) Exam., February - 2023****ESC Automobile Engineering****5AE3 – 01 Mechatronic Systems****AE, ME****Time: 2 Hours****Maximum Marks: 80****Min. Passing Marks: 28***Instructions to Candidates:*

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL2. NIL**PART – A****(Answer should be given up to 25 words only)****[5×2=10]****All questions are compulsory**

Q.1 What are the parameters to be considered for designing an intelligent Mechatronics system?

Q.2 Identify the sensors in a pick and place robot.

Q.3 What are the advantages of using a microprocessor in place of mechanical controller in a carburetor of an automobile?

Q.4 What are the advantages and disadvantages of PID Control?

Q.5 Write the advantages of an FET over a BJT.

PART – B**(Analytical/Problem solving questions)****[4×10=40]****Attempt any four questions**

- Q.1 Draw a block diagram of a basic microcontroller and explain the function of each subsystems.
- Q.2 Explain, how a Thyristor can be used to control the level of a DC voltage by chopping the output from a constant voltage supply.
- Q.3 What is a programmable logic controller and how is it different from a microprocessor/microcontroller system?
- Q.4 Identify and explain the sensor, signal conditioner and display element in the measurement system of a Bourdon pressure gauge.
- Q.5 Draw a typical pneumatic circuit and explain its working.
- Q.6 Identify and explain the functions of the various control elements of an automatic camera.

PART – C**(Descriptive/Analytical/Problem Solving/Design Questions)****[2×15=30]****Attempt any two questions**

- Q.1 What are the various types of models used to describe a system? Explain the mathematical models with suitable examples.
- Q.2 Draw the architecture of an 8051 microcontroller and explain the role of each component.
- Q.3 Design a vehicle engine management system on the basis of mechatronics system design.
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5E6202

Roll No. _____

Total No. of Pages: 4**5E6202****B. Tech. V - Sem. (Back) Exam., February - 2023****Mechanical Engineering
5ME2A Dynamics of Machines
AE, ME****Time: 3 Hours****Maximum Marks: 80****Min. Passing Marks: 24***Instructions to Candidates:*

*Attempt any **five** questions, selecting **one** question from **each** unit.
All questions carry **equal** marks. Schematic diagrams must be shown wherever
necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL2. NIL**UNIT- I**

Q.1 (a) Define and explain the following terms related to governors - [8]

- (i) Stability
- (ii) Sensitiveness
- (iii) Isochronism
- (iv) Hunting

- (b) A governor of the Proell type has each arm 250 mm long. The pivots of the upper and lower arms are 25 mm from the axis. The central load acting on the sleeve has a mass of 25 kg and each rotating ball has a mass of 3.2 kg. When the governor sleeve is in mid-position, the extension link of the lower arm is vertical and the radius of the path of rotation of the masses is 175 mm. The vertical height of the governor is 200 mm. If the governor speed is 160 r.p.m., when in mid-position. Find - [8]

- (i) Length of the extension link
- (ii) Tension in the upper arm

OR

- Q.1 (a) Discuss the controlling force and stability of a governor and show that the stability of a governor depends on the slope of the curve connecting the controlling force (F_c) and radius of rotation (r) and the value (F_c/r). [8]
- (b) The radius of rotation of the balls of a Hartnell governor is 80 mm at the minimum speed of 300 r.p.m. Neglecting gravity effect, determine the speed after the sleeve has lifted by 60 mm. Also, determine the initial compression of the spring, the governor effort and the power. The particulars of the governor are:
Length of ball arm=150 mm; length of sleeve arm=100 mm; mass of each ball=4 kg; and stiffness of the spring = 25 N/mm. [8]

UNIT- II

- Q.2 (a) Discuss the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn. [8]
- (b) The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stern.
Determine the gyroscopic couple and its effect upon the ship - [8]
- (i) When the ship is steering to the left on a curve of 100m radius at a speed of 36 km/h
- (ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity
- The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.

OR

- Q.2 (a) The turning moment diagram for a multicylinder engine has been drawn to a scale 1 mm=600 N-m vertically and 1 mm=3° horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows: +52,-124,+92,-140,+85,-72 and + 107 mm², when the engine is running at a speed of 600 r.p.m. If the total fluctuation of speed is not to exceed $\pm 1.5\%$ of the mean, find the necessary mass of the flywheel of radius 0.5 m. [8]
- (b) The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressures is 0.35 N/mm². The connecting rod length between centers is 1.2 m and the cylinder bore is 0.5 m. If the engine runs at 250 r.p.m. and if the effect of piston rod diameter is neglected.
Calculate - [8]
- (i) Pressure on slide bars
- (ii) Thrust in the connecting rod
- (iii) Tangential force on the crank-pin
- (iv) Turning moment on the crank shaft

UNIT- III

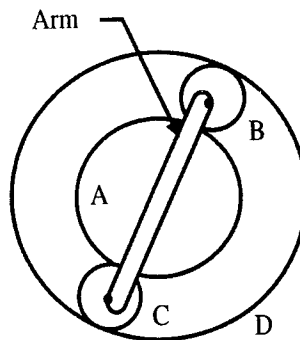
- Q.3 (a) Derive an expression for minimum number of teeth required on a pinion to avoid interference when it gears with a rack. [8]
- (b) Determine the minimum number of teeth required on a pinion, in order to avoid interference which is to gear with – [8]
- (i) A wheel to give a gear ratio of 3 to 1
 - (ii) An equal wheel
- The pressure angle is 20° and a standard addendum of 1 module for the wheel may assumed.

OR

- Q.3 (a) State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing. [8]
- (b) A pair of 20° full depth involute spur gears having 30 and 50 teeth respectively of module 4mm are in mesh. The smaller gear rotates at 1000 r.p.m. Determine – [8]
- (i) Sliding velocities at engagement and at disengagement of pair of a tooth
 - (ii) Contact ratio

UNIT- IV

- Q.4 (a) What do you understand by 'gear train'? Discuss the various types of gear trains. [6]
- (b) An epicyclic train of gears is arranged as shown in figure below. How many revolutions does the arm, to which the pinions B and C are attached makes? [10]
- (i) When A makes one revolution clockwise and D makes half a revolution anti-clockwise.
 - (ii) When A makes one revolution clockwise and D is stationary. The number of teeth on the gears A and D are 40 and 90 respectively.



OR

- Q.4 (a) Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m., find the speed of shaft B. [8]
- (b) Explain the working of constant mesh gear box with neat sketch. [8]

UNIT- V

- Q.5 (a) Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass. [8]
- (b) A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45° , B to C 70° and C to D 120° . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. [8]

OR

- Q.5 (a) The following data apply to an outside cylinder uncoupled locomotive: Mass of rotating parts per cylinder=360 kg; Mass of reciprocating parts per cylinder=300 kg; Angle between cranks= 90° ; Crank radius = 0.3 m; Cylinder centres=1.75 m; Radius of balance masses=0.75 m; wheel centres=1.45 m. If whole of the rotating and two-thirds of reciprocating parts are to be balanced in planes of the driving wheels. Find - [10]
- Magnitude and angular positions of balance masses
 - Speed in kilometers per hour at which the wheel will lift off the rails when the load on each driving wheel is 30 kN and the diameter of tread of driving wheels is 1.8 m
 - Swaying couple at speed arrived at in (2) above
- (b) Discuss the balancing of V-engines. [6]
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B. Tech. V - Sem. (Main) Exam., February - 2023

Automobile Engineering

5AE4 – 02 Heat Transfer

AE, ME

Time: 3 Hours

Maximum Marks: 70

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[10×2=20]

All questions are compulsory

- Q.1 What is Fourier Law of Conduction?
- Q.2 Write expression of diffusion equation.
- Q.3 What do you mean by critical radius of insulation?
- Q.4 What is Biot number? What is its physical significance?
- Q.5 Convective heat transfer depends on which factors?
- Q.6 Define Nusselt number, Prandtl number and Grashof number.
- Q.7 Construct the pool boiling curve.
- Q.8 What is fouling factor?
- Q.9 Define a geometrical or shape factor.
- Q.10 Write formula for radiation heat transfer between two surfaces.

[5E1719]

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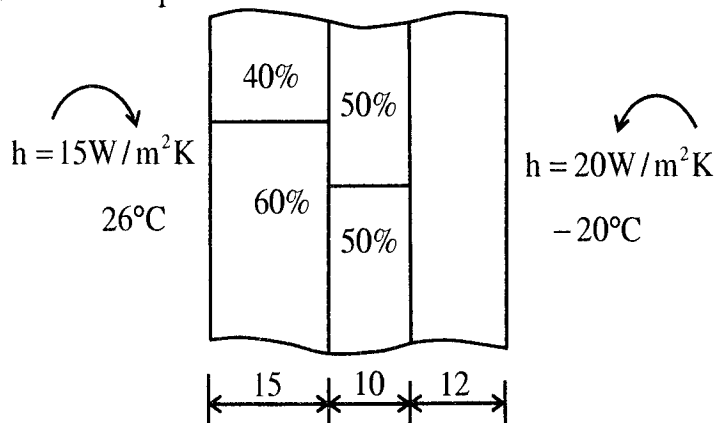
PART – B

(Analytical/Problem solving questions)

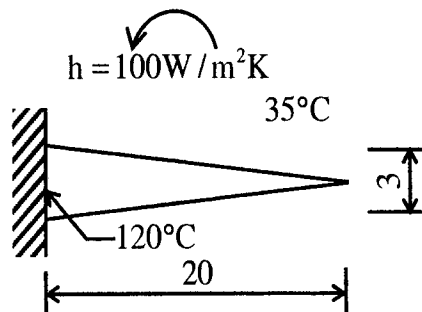
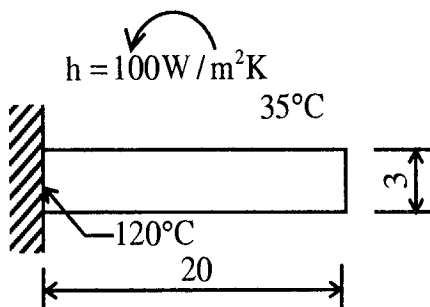
[5×4=20]

Attempt any five questions

- Q.1 A composite slab is made of three layers 15 cm, 10 cm and 12 cm thickness. The first layer is of material with thermal conductivity 1.45 for 60% of the area and the rest is of material with conductivity of 2.5 W/mK. The second layer is made of material with conductivity of 12.5 W/mK for 50% and of material with conductivity 18.5 W/mK is used for other 50%. The third layer is of single material of thermal conductivity 0.76 W/mK. The slab is exposed on one side to warm air at 26°C and to cold air at -20°C on the other side. The convection coefficients are 15 and 20 W/m²K on the inside and outside respectively. Determine the heat flow and interface temperatures.



- Q.2 Determine the heat flow for –
- Rectangular fins and
 - Triangular fins of 20mm length and 3mm base thickness having base temperature of 120°C. Thermal conductivity of fin material is 45W/mK. Convection heat transfer coefficient and temperature of surrounding area of fin is 100W/m²K and 35°C, respectively. Also, determine the fin effectiveness. Use heat and mass transfer data handbook.



- Q.3 A steel ball [$c = 0.46$ kJ/kg°C, $k = 35$ W/m°C] 5.0 cm in diameter and initially at a uniform temperature of 450°C is suddenly placed in a controlled environment in which the temperature is maintained at 100°C. The convection heat-transfer coefficient is 10 W/m²°C. Calculate the time required for the ball to attain a temperature of 150°C.

Q.4 Discuss :

- (a) Hydrodynamic boundary layer and
- (b) Thermal boundary layer

Q.5 A steam pipe 50 mm diameter and 2.5 meter long has been placed horizontally and exposed to steel air at 25°C. If the pipe wall temperature is 295°C, determine the rate of heat loss.

At the mean temperature of 160°C, the thermo-physical property of air are –

Conductivity, $k = 3.64 \times 10^{-2}$ W/m-degree

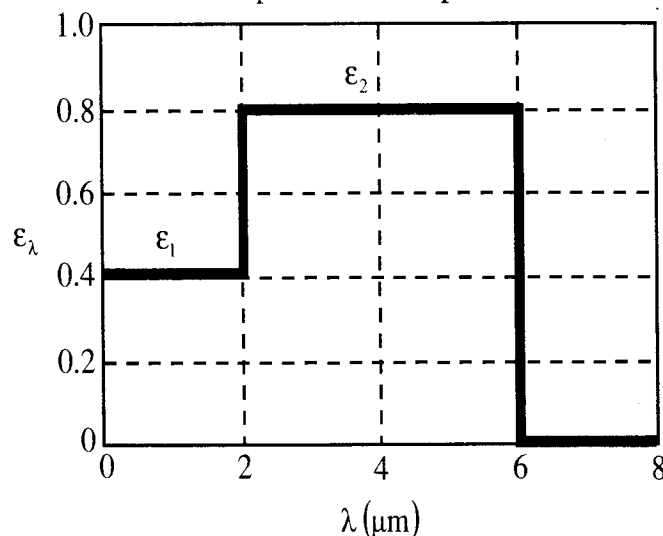
Kinematic viscosity, $\nu = 30.09 \times 10^{-6}$ m²/s

Prandtl number, $P_r = 0.682$

Use heat and mass transfer data book.

Q.6 A can of beverage with a height of 123 mm and a diameter of 66 mm has a uniform temperature of 5°C when it is removed from the refrigerator. The can is placed on a table in a room and moist air condenses on the outer surface of the can. Determine the dropwise condensation rate of the moisture in the air, if the saturation temperature is 25°C. The latent heat of vaporization of water at 25°C is 2442×10^3 J/kg. Specific heat capacity of liquid at average film temperature (15°C) is 4185 J/kg.K.

Q.7 A diffuse surface at 1500K has the spectral, hemispherical emissivity shown as follows -



Determine the total hemispherical emissivity and the total emissive power. Use heat and mass transfer data book for radiation functions.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [3×10=30]

Attempt any three questions

Q.1 Derive general heat conduction equation in cartesian coordinates.

Q.2 A 12 mm diameter mild steel sphere ($k = 42.5$ W/mK) is exposed to cool airflow at 27°C resulting in the convective heat transfer coefficient $h = 114$ W/m²K. Determine -

- (i) Time required to cool the sphere from 540°C to 95°C
- (ii) Instantaneous heat transfer rate 2 minutes after the start of cooling and
- (iii) Total energy transferred from the sphere during first 2 minutes.

The relevant properties of mild steel are :

Density $\rho = 7850 \text{ kg/m}^3$

Specific heat $c = 475 \text{ J/kg K}$ and

Thermal diffusivity $\alpha = 0.0043 \text{ m}^2/\text{hr}$

- Q.3 Air at 2 bar pressure and 200°C temperature gets heated as it flows through 2.5 cm diameter tube with a velocity of 10 m/s. A constant heat flux condition is maintained at the wall and wall temperature is 20°C above the air temperature all along the length of the tube. Make calculations for the heat transfer per unit length of tube. Also, determine the increase in bulk temperature over a 3 meter length of the tube. The appropriate correlation for the convection coefficient is –

$$Nu = 0.023 (Re)^{0.8} (Pr)^{0.4}$$

Where the different thermo-physical properties of air are :

$\mu = 2.57 \times 10^{-5} \text{ Ns/m}^2$

$k = 0.0385 \text{ W/m-deg}$

and $c_p = 1025 \text{ J/kgK}$

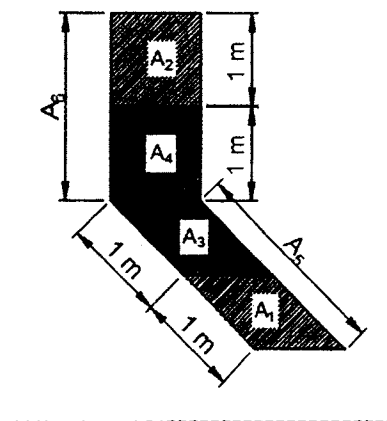
- Q.4 In an open-heart surgery under hypothermic conditions, the patient's blood is cooled before the surgery and rewarmed afterwards. The task is accomplished by a concentric tube counter-flow heat exchanger of length 500 mm with a thin-walled inner tube of 60 mm diameter. The blood entering the heat exchanger at 20°C and 0.05 kg/s. Determine the temperature of blood at exit from the heat exchanger and the heat flow rate. Assume the following data :

c_p of blood = 3500 J/kgK

and c_p of water = 4186 J/kgK

Overall heat transfer coefficient $U_0 = 475 \text{ W/m}^2 \text{ K}$

- Q.5 Find the shape factor F_{12} for the arrangement shown in the below figure. The areas A_1 and A_2 are perpendicular but do not share the common edge.



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5E1322

B. Tech. V - Sem. (Back) Exam., February - 2023

Automobile Engineering

5AE4 – 02 Heat Transfer

AE, ME

Time: 3 Hours

Maximum Marks: 120

Min. Passing Marks: 42

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[10×2=20]

All questions are compulsory

- Q.1 Define the thermal conductivity, thermal resistance and thermal conductance.
- Q.2 Define thermal diffusivity and explain its physical significance.
- Q.3 Write Fourier rate equation for heat transfer by conduction?
- Q.4 What is the overall heat transfer coefficient?
- Q.5 What is the extended surfaces? Give example.
- Q.6 What type of boundary condition is used at the fin edge?
- Q.7 Name the most common types of fins with sketch.

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Q.8 What is meant by lumped-capacity?

Q.9 Define terms absorptivity, reflectivity and transmissivity of a body.

Q.10 State the Stefan Boltzmann Law.

PART – B

(Analytical/Problem solving questions)

[5×8=40]

Attempt any five questions

Q.1 Show that for an incompressible homogeneous fluid with no internal heat generation, the energy equation can be expressed by -

$$\frac{Dt}{Dt} = a \nabla^2 t$$

Q.2 A 1.2 m thick slab of concrete ($k = 1.148 \text{ W/m-deg}$) having both side surface temperature of 20°C . During curing energy released at the rate of 80 W/m^3 . Assuming that temperature not varying with time, determine the maximum temperature of concrete. What would be the maximum thickness of concrete if the temperature gradient is limit to 98.5°C/m anywhere in the slab?

Q.3 Derive the governing differential equation for temperature distribution of constant area extended surface in the following form -

$$\frac{d^2 t}{dt^2} = \frac{hp}{kA_c} = m^2 \theta$$

Q.4 Prove that the temperature of a body at any time τ during Newtonian heating or cooling is given by the relation -

$$\frac{t-t_a}{t_i-t_a} = \exp[B_i F_0]$$

Q.5 Show the temperature variation along the length of heat exchanger when:

- (i) hot and cold fluids flow in parallel and counter flow fashion
- (ii) steam condenses on the outside of condenser tubes and water flowing inside the tubes as coolant.

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Q.6 Using the definition of radiosity and irradiation, prove that the radiant interchange between two gray bodies is given by relation:

$$Q_{\text{net}} = \frac{A_1 a_b (T_1^4 - T_2^4)}{\left\{ \frac{1-\epsilon_1}{\epsilon_1} \right\} + \left\{ \frac{1}{F_{12}} \right\} + \left\{ \frac{1-\epsilon_2}{\epsilon_2} \right\} \times \left\{ \frac{A_1}{A_2} \right\}}$$

Q.7 A counter-flow concentric tube heat exchanger is used to cool the lubricating oil of a large industrial gas turbine engine. The oil flows through the tube at 0.19 kg/s ($C_p=2.18$ kJ/kg K), and the coolant water flows in the annulus in the opposite direction at the rate of 0.15 kg/s ($C_p = 4.18$ kJ/kg K). The oil enters the oil enters the coolant at 425 K and leaves at 345 K while the coolant enters at 285 K. How long must the tube be made to perform this duty if the heat transfer coefficient from oil to tube surface is 2250 W/m² K and from tube surface to water is 5650 W/m² K? The tube has a mean diameter of 12.5mm and its wall presents negligible resistance to heat transfer.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [4×15=60]

Attempt any four questions

- Q.1 Explain the analogy between heat transfer by conduction and flow of electricity through Ohmic resistance. Illustrate the concept by considering composite wall of building.
- Q.2 Explain Nusselt number. How it is related to temperature gradient in the fluid immediately in contact with the solid surface? Mention the various approaches which have suggested for estimating the value of Nusselt number.
- Q.3 Two parallel walls each 1.25 m height, from 7.5 cm thick vertical slot containing air at atmospheric pressure. Make calculation for the effective thermal conductivity and heat flux if the hotter and cooler walls are at 77°C and 27°C temperature respectively.

Q.4 Example 14.18 A one-shell, two-tube pass heat exchanger having 3000 thin wall brass tubes of 20 mm diameter has been installed in a steam power plant with a load of 2.3×10^8 W. The steam condenses at 50°C and the cooling water enters the tube at 20°C at the rate of 3000 kg/s. Calculate the overall heat transfer coefficient, the tube length per pass and the rate of condensation of steam. Take the heat transfer coefficient for condensation on the outer surfaces of the tubes as $15500\text{ W/m}^2\text{ K}$ and latent heat of steam as 2380 kJ/kg . Further presume the following fluid properties -

$$c = 4180\text{ J/kg K}, \mu = 855 \times 10^{-6}\text{ Ns/m}^2, k = 0.613\text{ W/m K and Pr} = 5.83$$

Q.5 For laminar film condensation on a vertical plate, develop an expression for the film thickness, heat transfer coefficient and steam condensation rate in terms of relevant fluid properties, temperature difference and plate dimensions. Are the fluid properties involved evaluated for the vapour phase? If not, how are they evaluated?

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Total No. of Pages: 4

5E6201

B. Tech. V - Sem. (Back) Exam., February - 2023

Mechanical Engineering

5ME1A Heat Transfer

AE, ME

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks: 24

Instructions to Candidates:

Attempt any **five** questions, selecting **one** question from **each** unit. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. Heat Transfer Data Book
2. Property Table

UNIT- I

- Q.1 (a) The temperature distribution across a wall 1m thick at a certain instant of time is given as where T is in degrees Celsius and x is in meters, while $a = 800^\circ\text{C}$, $b = 200^\circ\text{C/m}$ and $c = 50^\circ\text{C/m}^2$. A uniform heat generation, $\dot{q} = 1100 \text{ W/m}^3$, is present in the wall of area 10m^2 having the properties $\rho = 1600 \text{ kg/m}^3$, $k = 40 \text{ W/m K}$, and $c_p = 4 \text{ kJ/kg K}$. [10]
- (i) Determine the rate of heat transfer entering the wall ($x = 0$) and leaving the wall ($x = 1\text{m}$).
 - (ii) Determine the rate of change of energy storage in the wall.
 - (iii) Determine the time rate of temperature change at $x = 0, 0.25$ and 0.5m .
- (b) Why is the thermal conductivity of solids generally larger than that of a liquid? Why is the thermal conductivity of liquids larger than that of a gas? [6]

OR

- Q.1 (a) Derive a heat diffusion equation for cylindrical coordinate. [8]
- (b) A thin silicon chip and an 8 mm thick aluminum substrate are separated by a 0.02 mm thick epoxy joint. The chip and substrate are each 10mm on a side and their exposed surfaces are cooled by air, which is at a temperature of 25°C and provides a convection coefficient of 100 W/m²K. If the chip dissipates 104 W/m² under normal conditions, will it operate below a maximum allowable temperature of 85°C? [8]

UNIT- II

Q.2 Distinguish between –

- (a) Natural and Forced convective heat transfer [4]
- (b) Laminar and Turbulent flow [4]
- (c) Biot number and Nusselt number [4]
- (d) Bulk mean temperature and Film temperature [4]

OR

- Q.2 (a) The engine cylinder of a motorcycle is constructed of 2024 T6 aluminum alloy ($K = 186 \text{ W/m.K}$) and is of height $H = 0.2\text{m}$ and outside diameter $D = 60 \text{ mm}$. Under typical operating conditions the outer surface of the cylinder is at a temperature of 550K and is exposed to ambient air at 280K, with a convection coefficient of 50 W/m²K. Annular fins are integrally cast with the cylinder to increase heat transfer to the surroundings. Consider five such fins which are of thickness $t = 5\text{mm}$, length $L = 22\text{mm}$ and equally spaced. What is the increase in heat transfer due to use of the fins? Also, comment on your result. [10]
- (b) How are the effectiveness, efficiency and thermal resistance of a fin affected if its thermal conductivity is increased? If the convection coefficient is increased? If the length of the fin is increased? If the thickness (or diameter) of the fin is increased? [6]

UNIT- III

Q.3 (a) Define Grashof number and explain its significance in free convection heat transfer. [6]

(b) A 30cm long plate is hung vertically in the air at 29°C while its temperature is maintained at 78°C . Calculate the boundary layer thickness at the trailing edge of the plate.

If a similar plate is placed in a wind tunnel and air is blown over it at a velocity of 5m/s, estimate the boundary layer thickness at its trailing edge. [10]

OR

Q.3 (a) Distinguish between film wise and drop wise condensation. Which of the two gives a higher heat transfer coefficient and Why? [8]

(b) Discuss briefly the various regimes in boiling heat transfer. [8]

UNIT- IV

Q.4 (a) Discuss the advantage of NTU method over the LMTD method of heat exchanger design. [6]

(b) A refrigerator is designed to cool 250 kg/h of hot liquid of specific heat 3350 J/kg.K at 120°C using a parallel flow arrangement. 1000kg/h of cooling water is available for cooling purposes at a temperature of 10°C . If the overall heat transfer coefficient is $1160 \text{ W/m}^2.\text{K}$ and the surface area of the surface area of the heat exchanger is 0.25 m^2 . Calculate the overall temperatures of the cooled liquid and water and also the effectiveness of the heat exchanger. [10]

OR

Q.4 (a) Derive an expression for the effectiveness of a heat exchanger in which a condensing vapour is used to heat the cold fluid. [8]

(b) Hot oil with a capacity rate of 2500 W/K flows through a double pipe heat exchanger. It enters at 350°C and leaves at 300°C . Cold fluid enters at 32°C and leaves at 20°C . If the overall heat transfer coefficient is $850 \text{ W/m}^2.\text{K}$. Determine the heat exchanger area required for – [8]

(i) Counter flow

(ii) Parallel flow

UNIT- V

- Q.5 (a) Write short notes on the following – [8]
- (i) Planck's distribution law
 - (ii) Wein's displacement law
 - (iii) Hemispherical emissive power
 - (iv) Intensity of radiation
- (b) Two parallel plates of size 1.0 m by 1.0 m spaced 0.5 m apart are located in a very large room, the walls of which are maintained at a temperature of 29°C. One plate is maintained at a temperature of 900°C and the other at 400°C. Their emissivities are 0.2 and 0.5 respectively. If the plates exchange heat between themselves and surroundings, find the net transfer to each plate and to the room. Consider only the plate surfaces facing each other. [8]

OR

- Q.5 (a) Derive an equation of radiation exchange between large gray concentric cylinders. [8]
- (b) Distinguish between - [8]
- (i) A black body and gray body
 - (ii) Specular and diffuse surfaces
 - (iii) Absorptivity and emissivity of a surface
-

5E1720

Roll No. _____

Total No. of Pages: 2

5E1720

B. Tech. V - Sem. (Main) Exam., February - 2023

Automobile Engineering

5AE4 – 03 Manufacturing Technology

AE, ME

Time: 3 Hours

Maximum Marks: 70

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[10×2=20]

All questions are compulsory

- Q.1 State the conditions under positive and negative rake angles are recommended.
- Q.2 What are the conditions favorable for Built up Edge formation?
- Q.3 What is the effect of cutting speed and feed rate on the force on cutting tool?
- Q.4 Differentiate between cutting tool and machine tool with suitable example.
- Q.5 Differentiate between honing and lapping.
- Q.6 Differentiate between orthogonal cutting and oblique cutting.
- Q.7 Which coolants would you suggest for turning of mild steel, aluminum and copper with high speed steel tool?
- Q.8 Differentiate between up – milling and down – milling.
- Q.9 What are the abrasives used in manufacture of grinding wheels?
- Q.10 Write complete specification of a grinding wheel.

PART – B

(Analytical/Problem solving questions)

[5×4=20]

Attempt any five questions

- Q.1 During an orthogonal cutting a chip length of 160 mm was obtained from an uncut chip length of 350 mm. The cutting tool has 220 rake angles and a depth of cut in 0.8 mm. Determine the shear plane angle and chip thickness.
- Q.2 Name the different work holding devices or methods in capstan and turret lathes. Describe any one with a neat sketch.
- Q.3 Draw a tool layout for production of hexagonal nut using turret lathe machine.
- Q.4 How the stroke length and positions are adjusted of shaper machine? Explain with a neat sketch.
- Q.5 Explain the electro – hydraulic forming process.
- Q.6 What is the principle of magnetic pulse forming? Describe the type of components that may be made by this process.
- Q.7 What are the various factors to be considered in selection of a grinding wheel? Discuss each in detail.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

[3×10=30]

Attempt any three questions

- Q.1 A 125 mm long, 10 mm diameter stainless steel rod is being reduced in diameter to 9 mm by turning on a lathe. The spindle rotates at $N = 360$ rpm and the tool is traveling at an axial speed of 175 mm/min. Let Specific energy requirement in cutting stainless steel rod is $4 W - S / \text{mm}^3$. Calculate the cutting speed, material removal rate, cutting time, power dissipated and cutting force.
- Q.2 A mild steel bar is turned with HSS tool. Determine the tool life for cutting velocity of 40 m/min, if the tool life equation is $VT^{0.2} = 80$. Also, determine the cutting speed for 60 minute tool life.
- Q.3 Enumerate the factors affecting tool life. Briefly, explain the effect of each factor.
- Q.4 Discuss the different mechanisms of tool wear.
- Q.5 Sketch a single point cutting tool and show on it the various tool elements and tool angles. Describe the tool represented by 10, 9, 6, 5, 8, 7, 1 mm in ASA system.
-

5E1323

Roll No. _____

Total No. of Pages: 2

5E1323

B. Tech. V - Sem. (Back) Exam., February - 2023

Automobile Engineering

5AE4 – 03 Manufacturing Technology

AE, ME

Time: 3 Hours

Maximum Marks: 120

Min. Passing Marks: 42

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[10×2=20]

All questions are compulsory

- Q.1 Define Built-Up-Edge (BUE) with a neat sketch.
- Q.2 Differentiate between machine and machine tool.
- Q.3 What is crater and flank wear in cutting tools?
- Q.4 Write the Taylor's tool life equation.
- Q.5 Define chip thickness ratio.
- Q.6 What are the different functions of cutting fluids?
- Q.7 Differentiate between hydraulic forming and electro-hydraulic forming.
- Q.8 What is magnetic pulse forming?
- Q.9 What is meant by an automatic lathe?
- Q.10 What is the function of a lead screw in a lathe machine?

PART – B

(Analytical/Problem solving questions)

[5×8=40]

Attempt any five questions

- Q.1 Differentiate between flank wear and crater wear with the help of neat sketches.
- Q.2 Enumerate the various parts of a single-point cutting tool. What is a tool signature?
- Q.3 Explain the constructional features of a horizontal knee and column milling machine with a neat sketch.
- Q.4 What are the high velocity forming methods?
- Q.5 Differentiate between a capstan and turret lathe.
- Q.6 How do we estimate machining time in a milling cutter?
- Q.7 Derive the expression for shear angle in orthogonal cutting in terms of rake angle and chip thickness ratio.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

[4×15=60]

Attempt any four questions

- Q.1 What is meant by machinability? Explain the method of representing the machinability. Explain ANY 3 parameters that control the tool life of a single point cutting tool.
- Q.2 ABC Steels Pvt. Ltd, uses the following data related to turning of its mild steel rods of 30 mm diameter. As a production engineer in the organization, determine the following parameters: -
 - (a) Shear angle
 - (b) Shear force and Compression force
 - (c) Coefficient of friction between chip and tool face.
 Take Feed force = 850 N; Cutting force = 1600 N; Chip thickness ratio = 0.26 and Tool rake angle = 10.
- Q.3 Explain the American Standard Association (ASA) system of tool nomenclature with a neat sketch.
- Q.4 XYZ Industries Pvt. Ltd, uses the following data related to shaping the surface 850 mm in length and 700 mm in width. As a production engineer in the organization, determine the machining time needed to machine it. Take cutting speed as 7m/ min. The return to cutting time ratio is 1:3, and the feed is 2 mm/ double stroke (cycle). The tool clearance at each end of the stroke is 50 mm.
- Q.5 How is grinding different from other machining operations? Discuss the various types of bonds used in manufacturing of a grinding wheel.

5E6203

Roll No. _____

Total No. of Pages: 3

5E6203

B. Tech. V - Sem. (Back) Exam., February - 2023
Production & Industrial Engineering
5PI3A Measurement and Metrology
ME, PI

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 24

Instructions to Candidates:

Attempt any five questions, selecting one question from each unit.
All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.
Units of quantities used/calculated must be stated clearly.
Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL

2. NIL

UNIT- I

- Q.1 (a) What do you mean by Metrology? Explain. [4]
(b) Define following terms – [6]
(i) Sensitivity
(ii) Readability
(iii) Range of Accuracy
(c) State the difference between Accuracy & Precision. Explain with Example. [6]

OR

- Q.1 (a) Differentiate between Repeatability and Reproducibility. [4]
(b) What is the importance of measuring Errors? State different types of Errors. [4]
(c) What do you mean by Correction & Calibration? Are they same? If not, then state why? [4]
(d) What is interchangeability? Explain with examples. [4]

UNIT- II

- Q.2 (a) Define – Limits, Fits and Tolerances. [4]
- (b) Explain different types of fits with diagrams. [6]
- (c) Define GO & NO-GO gauges. State their advantages & disadvantages. [6]

OR

- Q.2 (a) Briefly Explain with diagrams – [12]
- (i) Mechanical comparator
- (ii) Electrical comparator
- (iii) Optical comparator
- (iv) Pneumatic comparator
- (b) State working principle of Autocollimator with its application. [4]

UNIT- III

- Q.3 (a) For a machined surface, show macro and micro irregularities. What are their causes?
What are the various measures of surface finish? Explain any three of them. [10]
- (b) Explain the working of Parkinson gear tester with schematic. [6]

OR

- Q.3 (a) Explain how flatness of a surface is measured with an optical flat. [8]
- (b) How the effective diameter or the pitch diameter of a screw thread measure? Explain with any one method. [8]

UNIT- IV

- Q.4 (a) What are interferometers? Why they are used? [6]
(b) Explain Laser Interferometry with diagram. [6]
(c) Name the alignment test performed on milling machine. [4]

OR

- Q.4 (a) What are the various Geometrical checks on machine tool? [4]
(b) Distinguish between Alignment Test and Performance test of a machine tool. [6]
(c) Briefly explain Co-ordinate measuring machine with figure. [6]

UNIT- V

- Q.5 (a) With a schematic, explain the torque measurement using Torsion Bars. [8]
(b) List different types of Dynamometers used for measurement of power. Explain any one of them. [8]

OR

- Q.5 (a) With neat sketch, explain Venturimeter for measuring a discharge of fluid in a pipe. [8]
(b) Explain and write applications of – [8]
(i) Thermocouples
(ii) Thermistors
(iii) Pyrometers
(iv) Bimetallic strip
-

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5E1721

Roll No. _____

Total No. of Pages: 4**5E1721****B. Tech. V - Sem. (Main) Exam., February - 2023****Automobile Engineering****5AE4 – 04 Design of Machine Elements - I****AE, ME****Time: 3 Hours****Maximum Marks: 70***Instructions to Candidates:**Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.**Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.**Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*1. NIL2. NIL**PART – A****(Answer should be given up to 25 words only)****[10×2=20]****All questions are compulsory**

- Q.1 What are the desired characteristics of a good designer?
- Q.2 Classify plain carbon steel on the basis of carbon percentage.
- Q.3 What are the factors to be considered while selecting an engineering material?
- Q.4 What is factor of safety? Why it is sometimes called factor of ignorance?
- Q.5 What are the advantages of interchangeability?
- Q.6 What are various modes of failure of engineering materials?
- Q.7 Why third type of lever is not preferred for engineering applications?
- Q.8 What is fatigue failure? Why it is so dangerous?
- Q.9 Compare rigid coupling and flexible coupling.
- Q.10 What are the drawbacks of a saddle key? How it is different from a sunk key?

PART – B

(Analytical/Problem solving questions)

[5×4=20]

Attempt any five questions

Q.1 (a) Give BIS designation of engineering materials having following chemical composition-

- (i) Free cutting steel having 0.25% Carbon, 1.2% Manganese and 0.14% Sulphur
- (ii) Alloy steel with Carbon = 0.12 to 0.18%; Silicon = 0.15 to 0.35%;
Manganese = 0.4 to 0.6% and Chromium = 0.5 to 0.8%

(b) Give chemical composition of engineering materials having following BIS codes:

- (i) X15Cr25Ni12
- (ii) 40Ni8Cr8V2

Q.2 A 75mm shaft rotates in a bearing. The tolerance for both shaft and bearing is 0.075mm and required allowance is 0.10mm. Determine the dimensions of the shaft and the bearing bore on the basis of hole basis system.

Q.3 What is stress concentration? How it can be mitigated? Discuss with the help of neat sketches.

Q.4 For a beam made of cast iron (ultimate strength as 200MPa and FOS as 2.5). Determine the dimensions of the cross section (Figure 1). The depth of the cross section is twice the width. Use maximum normal stress theory.

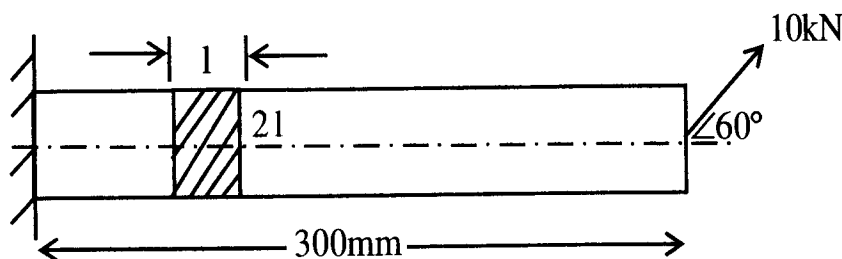


Figure 1

- Q.5 The cross-section of a flat key for a 40mm diameter shaft is 22×14mm. The power transmitted by the shaft to the hub is 25kW at 300rpm. The key is made of steel ($\sigma_{yc} = \sigma_{yt} = 300\text{MPa}$) and the factor of safety is 2.8. Determine the length of the key. Assume Distortion Energy Theory.
- Q.6 A semi-elliptic leaf spring consists of two extra full-length leaves and six graduated length leaves, including the master leaf. Each leaf is 7.5mm thick and 50mm wide. The centre-to-centre distance between the two eyes is 1m. The leaves are pre-stressed in such a way that when the load is maximum, stresses induced in all the leaves are equal to 350MPa. Determine the maximum load that the spring can withstand.
- Q.7 A link of S-shape made of a round steel bar is shown in Figure 2. It is made of plain carbon steel 45C8 ($\sigma_y = 380\text{MPa}$) and the factor of safety is 4.5. Calculate the dimensions of the link.

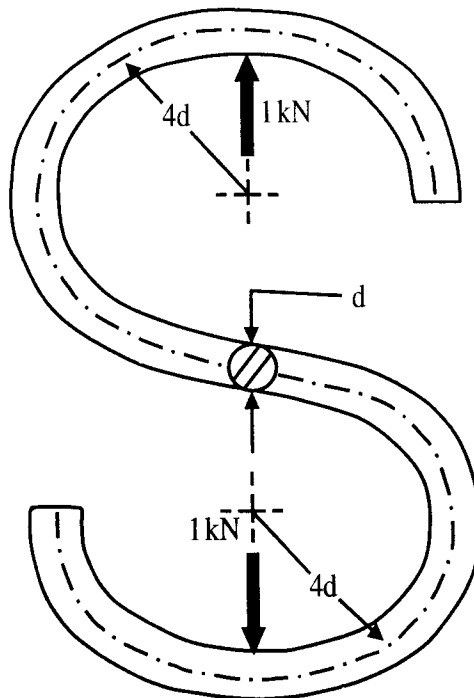


Figure 2

37.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [3×10=30]

Attempt any three questions

- Q.1 What are various design considerations of components made from Casting and Forging? Discuss with the help of neat sketches.
- Q.2 A protective flange coupling is used to connect two shafts and transmit 7.5kW power at 720rpm. The design torque is 150% of the rated torque. The shafts and bolts are made of plain carbon steel 30C8 ($\sigma_y = 400\text{MPa}$) and the factor of safety is 5. The flanges are made of cast iron. Calculate :
- (i) Diameter of the shafts;
 - (ii) Number of bolts; and
 - (iii) Diameter of the bolts.
- Assume maximum shear stress theory.
- Q.3 Power is transmitted by a shaft 900mm long and is supported at the ends. A pulley of diameter 420mm is placed at 150mm to the left of right-hand bearing and another pulley of diameter 270mm is mounted midway between the bearing. Determine the diameter of the shaft transmitting 24kW at 300rpm using both Maximum Shear Stress Theory and Maximum Normal Stress Theory. The permissible tensile and shear stresses for the shaft material are 120MPa and 80MPa respectively. The belt drives are at right angle to each other with tension ratios as 3:1.
- Q.4 Draw a neat sketch of a Spigot and Socket Cotter joint. Also, explain the design procedure of spigot, socket and cotter with the help of governing equations.
- Q.5 A double-threaded power screw is used to raise a load of 5kN. The nominal diameter is 60mm and the pitch is 9mm. The threads are Acme type ($2\theta = 29^\circ$) and the coefficient of friction at the screw threads is 0.15. Neglecting collar friction, Calculate :
- (i) The torque required to raise the load;
 - (ii) The torque required to lower the load;
 - (iii) The efficiency of the screw for lifting load.
-

5E1324

Roll No. _____

Total No. of Pages: 3

5E1324

B. Tech. V - Sem. (Back) Exam., February - 2023

Automobile Engineering

5AE4 – 04 Design of Machine Elements - I

AE, ME

Time: 3 Hours

Maximum Marks: 120

Min. Passing Marks: 42

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[10×2=20]

All questions are compulsory

Q.1 What is the purpose of standardization?

Q.2 What do you mean by preloading of bolts?

Q.3 A hole of 50mm has tolerance as C10. Calculate the maximum and minimum sizes.

Q.4 What is meant by rigidity of a shaft?

Q.5 Name various types of coupling.

- Q.6 What do you mean by Nipping? Why it is done for leaf springs?
- Q.7 What are parameters to be considered while selecting a suitable material?
- Q.8 Define surface roughness and what is the unit to measure it?
- Q.9 Define fits and Name different types of fits.
- Q.10 What is meant by self-locking screw? What is the efficiency of such screws?

PART – B

(Analytical/Problem solving questions)

[5×8=40]

Attempt any five questions

- Q.1 Derive an expression for the maximum efficiency of a power screw.
- Q.2 A solid shaft is transmitting IMW at 240rpm. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress at 60MPa.
- Q.3 Describe the various terms used in reference to threads with a sketch.
- Q.4 Distinguish between cotter and knuckle joint. Also, write their applications.
- Q.5 Determine the design stress for a piston rod where the load is completely reversed. The surface of the rod is ground and the surface factor is 0.9. There is no stress concentration. The load is predictable and factor of safety is 2.
- Q.6 A shaft has basic size of 50mm with its limits as 49.8mm and 49.7mm. Find its fundamental deviation zone and IT grade tolerance.
- Q.7 Define stress concentration and methods of reducing it.

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PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

[4×15=60]

Attempt any four questions

- Q.1 A locomotive semi elliptical laminated spring has an overall length of 1m and sustains a load of 70kN at its centre. The spring has 3 full length leaves and 15 graduated leaves with a central band of 100mm width. All the leaves are to be stressed to 400MPa, when fully loaded. The ratio of the total depth to that of width is 2. $E = 210 \text{ kN/mm}^2$. Determine –
- (a) The thickness and width of leaves
 - (b) The initial gap that should be provided between the full length and graduated leaves before the band load is applied.
 - (c) The load exerted on the band after the spring is assembled.
- Q.2 Calculate the tolerances, fundamental deviations and limits of sizes for the shaft designated as 40H8/f7.
- Q.3 Define any ten mechanical properties.
- Q.4 Design and draw a cotter joint to support a load varying from 30kN in compression to 30kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically.
- Given, Tensile stress = compressive stress = 50MPa, shear stress = 35MPa and Crushing stress = 90MPa.
- Q.5 Design and make a neat sketch of muff coupling which is used to connect two steel shafts transmitting 40kW at 350 rpm. The materials for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15MPa.
-

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5E6204

Roll No. _____

Total No. of Pages: **3**

5E6204

B. Tech. V - Sem. (Back) Exam., February - 2023
Mechanical Engineering
5ME4A Quality Assurance and Reliability

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each** unit.
All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.
Units of quantities used/calculated must be stated clearly.
Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

UNIT- I

- Q.1 (a) What is meant by dimensions of quality? Explain dimensions of service quality. [8]
- (b) Explain different costs of quality. [8]

OR

- Q.1 (a) Explain the concept of quality policy and its need. [8]
- (b) Differentiate between quality of design and quality of conformance. [8]

UNIT- II

- Q.2 (a) Distinguish between chance causes and assignable causes with examples. [8]
- (b) Subgroups of 5 items each are taken from a manufacturing process at regular intervals. A certain quality characteristic is measured and \bar{x} and R values are computed for each subgroup. After 25 subgroups $\Sigma \bar{x} = 357.50$ and $\Sigma R = 8.80$ - [8]
- (i) Compute the control limits for \bar{x} and R charts.
- (ii) If the specification limits are 14.40 ± 0.40 , what conclusion can you draw about the ability of the existing process to produce items within their specifications?

OR

- Q.2 (a) Explain the basis and working of control charts for mean and range. Also state the assumptions on which \bar{x} and R charts are developed. [8]
- (b) Give brief account of process capability. [8]

UNIT- III

- Q.3 (a) Explain in detail about p chart and c chart. [8]
- (b) Explain the concept of six sigma in manufacturing. [8]

OR

- Q.3 Certain locomotive parts are inspected by a random method. The results of inspection are given below. Construct a suitable control chart and comment on the process. The number of units inspected in each case is 200 - [16]

Sample no.	1	2	3	4	5	6	7	8	9	10	11	12
No. of defectives	22	16	18	14	38	3	20	36	26	8	0	19

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UNIT- IV

- Q.4 (a) Explain in detail about sequential sampling plan. [8]
(b) Explain the characteristics of OC curve. [8]

OR

- Q.4 (a) What are the advantages of sampling plan over 100% inspection? [8]
(b) What do you understand by ISO – 9000 system? Describe the procedure to obtain ISO – 9000 certificate. [8]

UNIT- V

- Q.5 (a) Compare reliability and quality with suitable examples. [8]
(b) Explain the bath-tub curve of a product and its significance in each stage. [8]

OR

- Q.5 Explain the following terms: [16]
(a) MTTF and MTBF
(b) Failure rate
(c) Hazard function
(d) Quality loss function
-

300

5E1722

Roll No. _____

Total No. of Pages: 3

B.Tech. V-Sem. (Main) Exam., February - 2023
Automobile Engg.
5AE4-05 Principles of Management
5E1722
AE,ME

Time: 3 Hours**Maximum Marks: 70***Instructions to Candidates:*

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
 (Mentioned in form No. 205)*

1. NIL2. NIL**PART – A****[10×2=20]****(Answer should be given up to 25 words only)****All questions are compulsory**

- Q.1 What are the functions of Management?
- Q.2 Define the term “Departmentation”.
- Q.3 What is Effective Communication?
- Q.4 What is Delegation?
- Q.5 “Planning is looking ahead and controlling is looking back” comment.

- Q.6 What is MBO?
- Q.7 Define the term "Performance Appraisal".
- Q.8 What is an Organisation?
- Q.9 Discuss the productivity problems in a management.
- Q.10 What are the elements in the Maslow's Hierarchy of needs?

PART – B

[5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

- Q.1 Define Management. Explain briefly the principles of Management according to Fayol.
- Q.2 Explain the different types of Communication.
- Q.3 Explain the concept of Decision Making.
- Q.4 Write a note on the following:
- (a) Organisation Structure
 - (b) Organisation Culture
- Q.5 Write a note on the following:
- (a) Span of Management
 - (b) Coordination
- Q.6 Write a note on the following:
- (a) Motivation
 - (b) Leadership
- Q.7 Explain the Two - Factor theory of Motivation and McGregor's Theory X and Theory Y?

PART – C

[3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

- Q.1 Write a note on the following:
- (a) Control Techniques and Information Technology
 - (b) Performance Appraisal and Career Strategy
- Q.2 What is Controlling? Explain the system and process of Controlling.
- Q.3 What do you understand by Managerial Ethics? How are these classified?
- Q.4 Differentiate between Centralisation & Decentralisation. Explain the advantages and disadvantages of Centralisation & Decentralisation.
- Q.5 Explain the concept of Total Quality Management (TQM).
-

5E1325

Roll No. _____

Total No. of Pages: 2

5E1325

B. Tech. V - Sem. (Back) Exam., February - 2023
PCC/ PEC Automobile Engineering
5AE4-05 Principles of Management
AE, ME

Time: 2 Hours

Maximum Marks: 80
Min. Passing Marks: 28

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

[5×2=10]

(Answer should be given up to 25 words only)

All questions are compulsory

- Q.1 Give the main importance of management.
- Q.2 Define organization.
- Q.3 Define staffing.
- Q.4 Define leading.
- Q.5 What are the functions of Managers?

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PART – B

[4×10=40]

(Analytical/Problem solving questions)

Attempt any four questions

- Q.1 Explain the various types of Leadership with its different styles.
- Q.2 What do you understand by organization chart? Explain the basis of the departmentalization.
- Q.3 Discuss briefly the various steps involved in organizing.
- Q.4 Discuss in detail about the performance appraisal.
- Q.5 Explain briefly about the various functions of Management.
- Q.6 Explain Total Quality Management.

PART – C

[2×15=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any two questions

- Q.1 What are the Henry Fayol's 14 principles of management? Explain
 - Q.2 Explain the overall decision making process.
 - Q.3 Explain briefly about the various types of organizational structures.
-

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5E6205

Roll No. _____

Total No. of Pages: 2

5E6205

B. Tech. V - Sem. (Back) Exam., February - 2023

Automobile Engineering

5AE5A Sociology and Economics for Engineers

AE.ME.PI

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks: 24

*Instructions to Candidates:**Attempt any five questions, selecting one question from each unit.**All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.**Units of quantities used/calculated must be stated clearly.**Use of following supporting material is permitted during examination.**(Mentioned in form No. 205)*1. NIL2. NIL**UNIT- I**

Q.1 Write short notes on the following -

(a) Different levels of social structure

[8]

(b) Culture social stratification

[8]

OR

Q.1 Write short notes on the following -

(a) Modernization and globalization

[8]

(b) Secularism and communalism

[8]

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UNIT- II

Q.2 Describe, how the work and organization is changing with time? [16]

OR

Q.2 Discuss the structure and salient features of Agrarian and Tribal society. [16]

UNIT- III

Q.3 Describe different structures of firm and market. [16]

OR

Q.3 Discuss different types of direct and indirect taxes. [16]

UNIT- IV

Q.4 Explain in brief the labour market and capital market. [16]

OR

Q.4 Define the term inflation. Explain the various types and causes of inflation. [16]

UNIT- V

Q.5 Discuss the role of urbanization in economic development. [16]

OR

Q.5 Explain the generation of employment through informal, organized and unorganized sectors. [16]

5E1724

Roll No. _____

Total No. of Pages: 2

5E1724

B. Tech. V - Sem. (Main) Exam., February - 2023
Automobile Engineering
5AE5 – 12 Automobile Engineering (Elective-I)
AE, ME

Time: 3 Hours

Maximum Marks: 70

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[10×2=20]

All questions are compulsory

- Q.1 Define toe in and toe out.
- Q.2 Give the name of various components of chassis.
- Q.3 Define over steering and under steering.
- Q.4 What are the functions of clutch?
- Q.5 What is synchromesh device?
- Q.6 Explain the all wheel drive.
- Q.7 Write various types of steering gear boxes.
- Q.8 Describe the advantages of radial ply tyres over bias ply tyres.
- Q.9 List the common faults related to automotive air conditioning system.
- Q.10 List the various safety requirements of an automobile.

PART – B

(Analytical/Problem solving questions)

[5×4=20]

Attempt any five questions

- Q.1 Explain the hydraulic torque converter.
- Q.2 Explain the operations of disc brake and drum brake system. Write its advantage and disadvantages.
- Q.3 Explain the constructional features of rear suspension system using leaf spring.
- Q.4 What is the necessity of differential in an automobile? Explain the construction and function of differential.
- Q.5 Draw and explain the layout of the vehicle battery charging system.
- Q.6 Explain the working principle of alternator and how alternator voltage and current output are controlled?
- Q.7 Explain, how does automobile air conditioning system differ from domestic air conditioning system?

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

[3×10=30]

Attempt any three questions

- Q.1 Explain the working of an automotive air conditioning system along with function of all component. How the evaporator icing is controlled?
 - Q.2 Draw and explain hydraulic power brakes. What is the function of viscosity in hydraulic braking system? How bleeding can be done in such braking system?
 - Q.3 What are the functions of wheel in an automobile? Explain the types and constructional features of tyre.
 - Q.4 Explain the significance and features of night vision system and global positioning system.
 - Q.5 What are the different types of gear boxes? With the help of neat sketch, explain the construction and working of sliding mesh gear box.
-

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5E1327

Roll No. _____

Total No. of Pages: 3

5E1327

B. Tech. V - Sem. (Back) Exam., February - 2023

Automobile Engineering

5AE5 – 12 Automobile Engineering

AE, ME

Time: 3 Hours

Maximum Marks: 120

Min. Passing Marks: 42

*Instructions to Candidates:**Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.**Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.**Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*1. NIL2. NIL**PART – A****(Answer should be given up to 25 words only)****[10×2=20]****All questions are compulsory**

Q.1 Explain the function of centrifugal clutch.

Q.2 Define the role of synchromesh gear box.

Q.3 List the various safety devices used in Automobile.

Q.4 Define overdrive in Automobile.

Q.5 What are the loads coming on a chassis frame?

[5E1327]

Page 1 of 3

- Q.6 Compare Hotchkiss and Torque tube drive.
- Q.7 List the common faults related to automotive air conditioning system.
- Q.8 What do you mean by tyre retreading?
- Q.9 What do you mean by power steering?
- Q.10 Explain the purpose and features of battery charging system.

PART – B

(Analytical/Problem solving questions)

[5×8=40]

Attempt any five questions

- Q.1 How is frame different from chassis? Discuss the design aspects and salient features of frame.
- Q.2 State the principle and derive the relation for correct steering of vehicle. Hence draw “Ackerman’s Steering Mechanism” and explain wheel lock and steering lock angles.
- Q.3 Explain the Magneto Ignition System with the help of schematic diagram. Compare its merits and demerits with Battery Ignition System.
- Q.4 Explain the construction and working of Hydraulic Torque Converter.
- Q.5 Write short notes on the following.
- (i) Head Lamp
 - (ii) Night vision system
 - (iii) Caster and Camber
 - (iv) Propeller shaft & universal joint
- Q.6 Describe briefly the construction and working of Alternator. Explain its principle and how voltage output is controlled?
- Q.7 What is refrigerant? Explain different types of refrigerants with their applications.

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PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

[4×15=60]

Attempt any four questions

- Q.1 Draw starter motor for automobile. Indicate all the parts and their roles and limitations.
- Q.2 What is the difference between sprung and un-sprung weight? Describe independent rear suspension system with neat sketch and explain how it affects ride quality?
- Q.3 List the advantages of variable displacement compressor over fixed displacement compressor in automotive air conditioning system. Explain safety devices used in automobiles.
- Q.4 How the size of clutch plate is determined? How does the uniform pressure criteria differ from the uniform wear consideration? How does the mean effective radius affect the torque transmitting ability in both the design criteria?
- Q.5 Explain the following with proper sketch –
- (i) Global Positioning System
 - (ii) Fuel Level Indicator
 - (iii) Toe in and Toe out
 - (iv) Brake shoes and Vacuum Brake
-

5E1328

Roll No. _____

Total No. of Pages: 3

5E1328

B. Tech. V - Sem. (Back) Exam., February - 2023
Automobile Engineering
5AE5-13 Non Destructive Evaluation & Testing
AE,ME

Time: 3 Hours

Maximum Marks: 120
Min. Passing Marks: 42

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

[10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

- Q.1 Compare Visible v/s Fluorescent Liquid Penetrant Testing Method.
- Q.2 What cannot be tested by LPT?
- Q.3 What are the main directions of magnetic field in magnetic particle inspection?
- Q.4 Enumerate briefly two main advantages of acoustic emission testing method of NDT.

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- Q.5 Which radiation producing device emits radiation of one or a few discrete wavelengths?
- Q.6 Write factor on which divergence of an ultrasonic beam is dependent.
- Q.7 Name the film processing step in which the undeveloped silver bromide is removed from the film emulsion.
- Q.8 What happens when a longitudinal wave sound beam passes through an acoustic interface at some angle other than zero degrees?
- Q.9 What is the advantage of using a focused transducer?
- Q.10 Briefly explain Principle of Acoustic Emission technique of NDT.

PART – B

[5×8=40]

(Analytical/Problem solving questions)

Attempt any five questions

- Q.1 Explain briefly steps involved in Liquid Penetrant Testing with suitable sketch.
- Q.2 What do you mean by Dwell Time? Explain its importance.
- Q.3 Explain briefly basic procedures and important considerations in Magnetic Particle inspection technique.
- Q.4 Which method is suitable for flaw detection in pressure vessels? Explain.
- Q.5 How thickness of non-conductive coating by Eddy current method is measured?
- Q.6 Explain Radiographic radiation hazard and safety precautions.
- Q.7 Compare Contact v/S Immersion Test Techniques of Ultrasonic Testing.

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PART – C

[4×15=60]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any four questions

- Q.1 How verification of Penetrant system Performance is carried out? Also, enumerate advantages and limitations of Liquid Penetrant Testing.
- Q.2 Explain method and importance of Demagnetisation in Magnetic Particle Inspection method of NDT.
- Q.3 Enumerate applications and limitations of Ultrasonic Inspection method for NDT.
- Q.4 Explain Principle of Ultrasonic Inspection. Also, explain constructional details of ultrasonic transducer with suitable sketch.
- Q.5 Explain Holography technique along with its industrial applications.
-

5E1326

Total No. of Questions:

Total No. of Pages:

Roll No. _____

B.Tech.V-Sem.(Back)Exam Feb. 2023
Automobile Engg.
5AE5-11Steam Engineering
5E1326
AE,ME

Time: 3 Hours

Maximum Marks: 120

Min. Passing Marks: 42

Attempt all ten questions from Part A, five question out of seven from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

1.Steam Table and Mollier Chart

2. Nil

Part A (Answer should be given up to 25 words only)
All questions are compulsory

- Q.1 Differentiate between water tube and fire tube boilers.
- Q.2 What are water wall and membrane water wall?
- Q.3 What are the effects of friction on nozzle performance?
- Q.4 What is carry over coefficient?
- Q.5 Define degree of reaction.
- Q.6 What is reheat factor? Is lower value of reheat factor desirable or higher one?
- Q.7 Reaction turbine stages are preferred to impulse stages even though the reaction turbines occupy more space and run slower. Comment on the statement.
- Q.8 Is it essential to reheat at optimum pressure? If yes, why?
- Q.9 What is the purpose of compounding of impulse turbines?
- Q.10 What do you mean by critical temperature and pressure of water?

10 x 2 = 20

Part B (Analytical/Problem solving questions)
Attempt any Five questions

- Q.1 What are drum internals and why are they required?
- Q.2 A nozzle expands steam from 14 bar and 300°C to 6 bar. If the flow rate is 1 kg/s, find the throat and exit area.
- Q.3 Find the condition of maximum blade efficiency in a single stage impulse turbine.
- Q.4 Calculate the maximum theoretical efficiency for a turbine stage having a degree of reaction of 0.5 and a velocity coefficient of 0.94 when the exit blade angle is 25°.
- Q.5 A steam turbine is divided into two sections, H.P. and L.P. with a reheater imposed in between the two sections. The steam on its way to the turbine at 30 bar and 500°C passes through a reheater where it gives up heat at constant pressure to heat the steam flowing from the H.P. turbine to the L.P. section. The steam then enters the H.P. turbine at 30 bar and 380°C. The steam leaves the H.P. turbine at 7 bar and the L.P. turbine at 0.07 bar. Assuming no loss of pressure between the two sections of the turbine and an internal efficiency of 0.8 for both the sections, determine the steam conditions at entrance to the L.P. section and the thermal efficiency of the plant.
- Q.6 Discuss the effects of air leakage on the performance of condenser.

Q.7 In a Parson's turbine, the blade angles at inlet and outlet are 75° and 20° respectively. The mean blade ring diameter is 90 cm and the rotor speed is 2000 RPM. If the steam enters the stage at 8 bar dry and saturated and 8 percent is lost in leakage, calculate the blade height for 160 kW to be developed in the stage. Assuming a stage efficiency of 0.75, determine the pressure drop in the ring.

5 x 8 = 40

Part C(Descriptive/Analytical/Problem Solving/Design questions)
Attempt any four questions

Q.1 Dry and saturated steam enters a steam turbine at 40 bar and exhausts at 0.07 bar. It is planned to use a regenerative feed heating system employing three heaters. (i) Design suitable extraction points and estimate the mass of steam taken by the heater per kg of feed. (ii) Find efficiency of the regenerative cycle.

Q.2 Explain stage velocity and force diagram for an impulse-reaction turbine with neat sketch.

Q.3 The data pertaining to an impulse turbine is as follows: Blade speed, 300 m/s; isentropic enthalpy drop, 450 kJ/kg; Nozzle efficiency, 0.9; Nozzle angle 20° ; blade velocity coefficient, 0.85; blade exit angle, 25° . Calculate for a mass flow rate of 1 kg/s (i) The inlet angle of moving blade (ii) Axial thrust (iii) Driving force and power.

Q.4 Explain the working of binary vapor power cycle with the help of line diagram and T-s/h-S plot.

Q.5 Explain with neat sketch reheat-regenerative feed heating cycle. Also draw T-s & h-s diagram.

4 x 15 = 60

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5E6207

Roll No. _____

Total No. of Pages: **3****5E6207****B. Tech. V - Sem. (Back) Exam., February - 2023****Mechanical Engineering****5ME6.2A Automobile Engineering****Time: 3 Hours****Maximum Marks: 80****Min. Passing Marks: 24***Instructions to Candidates:*

*Attempt any **five** questions, selecting **one** question from **each** unit.
All questions carry **equal** marks. Schematic diagrams must be shown wherever
necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL2. NIL

UNIT- I

Q.1 Describe with sketches for the following units of an automobile - [16]

- (a) The Chassis
- (b) The transmission system
- (c) The engine
- (d) The electrical components

OR

Q.1 What are the requirements of a good breaking system? Explain with a neat
sketch the construction and the working of a mechanical breaking system. [16]

UNIT- II

- Q.2 Describe the working of a synchronous gear box with a neat sketch. Also, give a suitable arrangement in which two forward, direct drive and neutral can be obtained from an automatic transmission gear box. [16]

OR

- Q.2 Explain the necessity of a differential in an automobile. Also, compare a Hotchkiss and Torque tube drive on the basis of the following - [16]
- (a) Construction
 - (b) Use
 - (c) Load shared

UNIT- III

- Q.3 Give briefly the description of the following steering parts - [16]
- (a) Steering wheel
 - (b) Steering gear box
 - (c) Steering shaft
 - (d) Drop arm

OR

- Q.3 List the requirements of a good suspension system. Describe in detail a leaf-spring rear suspension system with suitable diagram. [16]

UNIT- IV

- Q.4 Explain in detail the following ignition systems - [16]
- (a) Battery ignition system
 - (b) Magneto-ignition system

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OR

Q.4 Describe the various components of a lead acid battery with a neat sketch.

Also, explain in brief the following terms -

[16]

- (a) Battery voltage
- (b) Battery capacity
- (c) Battery efficiency
- (d) Battery rating

UNIT- V

Q.5 Describe in detail the different components of an automotive air conditioning system.

[16]

OR

Q.5 Write brief notes on the following safety features in an automobile -

[16]

- (a) Night Vision System
 - (b) Air bags
-