TE| sem VI| c-scheme R-19| Mechanical| QP-10068927 16/12/24.

Duration: 3hrs **Max Marks: 80**

N.B. **(1)** All questions carry equal marks.
(2) Question No. 1 is Compulsory.
(3) Attempt any three questions from remaining five questions.
(4) Figures to the right indicate full marks.
(5) Draw neat sketches wherever necessary.

Que. 1 Attempt any **four** of the following: (20)

A. How the milling cutters are classified?
B. Name the different types of chips formed in metal cutting. Describe each type with the help of neat sketches.
C. Give different types of cutting fluids? Explain any two in details?
D. Explain milling dynamometer with neat sketch.
E. Explain Built Up Edge (BUE) formation and its influence on surface finish.
F. Explain orthogonal rake system (ORS) in detail.

Que. 2 A. Discuss different cutting tool materials with their properties and application. (10)

B. The following observation were made during an orthogonal cutting operation: Depth of cut = 0.3 mm; Chip thickness = 0.6 mm: Rake angle = 20^0; Cutting velocity = 102 m/min; Cutting force = 300 N; Feed force = 120 N. (10)
Determine: (i) Shear angle. (ii) Shear strain. (iii) Velocity of chip along the tool face. (iv) Work done in shear

Que. 3 A. Calculate the length of broach for roughing and finishing operation for machining a slot 10 mm in depth and 20 mm in width for 400 mm long steel piece having specific cutting energy of 2000 N /mm^2. Cutting speed is 5 m/min and chip space number 8. Taking roughing feed as 0.08 mm/tooth and finishing feed as 0.02 mm/tooth. Assume blunt broach factor (1.25 to 1.40) (10)

B. Define Tool Life and explain factors affecting tool life. (10)

Que. 4 A. The tool life for a high speed steel (H. S. S.) tool is expressed by the relation $V T^{0.143} = C_1$ and for Tungsten carbide (WC) is expressed as $V T^{0.2} = C_2$. If at a speed of 24 metre / min. the tool life is 128 minutes compare the life of the tools at a speed 30 metre / min. (10)

B. What are the sources of heat generation in metal cutting and also explain the distribution of temperature during metal cutting process. (10)

Que. 5 A. Discuss the following design features of a reamer : (10)
Reaming allowance (ii) Diameter of reamer (iii) Length of body (iv) Back taper or relief (v) Rake and Clearance angle (vi) Number of teeth.

B i) Explain tool work thermocouple method with sketch for cutting temperature measurement. (10)
ii) Draw and explain design of simple step type chip Breaker.

Que. 6 A. Explain the various elements of a single – point cutting tool with the help of a neat diagram. Also explain machine reference system (MRS). (10)

B. Clearly stating the assumption derive the relationship $2\emptyset + \beta - \alpha = \frac{\pi}{2}$ in Merchant's original theory. (10)
Where; $\emptyset$ = Shear angle, α = Rake angle, β = Friction angle.

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QP-10064940 89424 12/12/24

(3 Hours) [Total marks: 80]

Instructions:
1. **Question 1 compulsory.**
2. Attempt any **three** questions from the remaining **five** questions.
3. Figures to the right indicate full marks.
4. Assume suitable data wherever required but justify the same.

Q.1. Solve ANY FOUR questions from following.

a	List four levels of automation with suitable examples.	**05**
b	Explain backpropagation algorithm used in Artificial Neural Networks.	**05**
c	Define Continuous path control system used in robotic system with suitable applications.	**05**
d	Summarize with a schematic block diagram, an automated system showing all the basic elements.	**05**
e	Explain the concept of Timers and Counters used in PLC architecture.	**05**

Q.2.	**a.**	Design an electro- pneumatic circuit for two-cylinder operation with following sequence using 5/2 both side solenoid operated valve as DCV. A+ , Delay B+ , A-B-	**10**
	b	Illustrate with neat diagram counter balance valve and Bleed off hydraulic circuits used in hydraulic system.	**10**
Q.3.	**a.**	Illustrate with neat sketches any three types of drives used in robotic system with its advantages and disadvantages.	**10**
	b.	Illustrate Goal based reflex agents and Model based intelligent agents in AI with examples.	**10**
Q.4	**a.**	Design a hydraulic circuit for two cylinder operation with following sequence using 4/2 pilot operated valve as DCV using cascade method , A+ , B+ , Delay B- , A-	**08**
	b	Differentiate between supervised and unsupervised techniques used in machine learning.	**07**
	c	Define the terms Robot Degrees of freedom for robotic system.	**05**
Q.5.	**a.**	Explain the significance of latching in PLC.	**06**
	b.	Illustrate K nearest neighbours algorithm used in machine learning.	**08**
	c.	Illustrate with neat sketches, the logic of AND and OR gates, used in operation of pneumatic circuits.	**06**
Q.6	**a.**	Differentiate between tree and graph search used in Machine Learning.	**08**
	b.	Illustrate the concept of Logistic regression in machine learning.	**06**
	c	Illustrate the concept of Artificial Neural Networks (AAN) in detail.	**06**

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QP-10065623

5/12/24

Time: 3 Hours

Max. Marks: 80

Instructions:

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining five** questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.
- Use of steam table is permitted.

			Marks
Q. 1		Solve **ANY FOUR** questions from following. (Each question carries 5 marks)	(20)
	a)	What will be the effect on multi stage compressor if the intercooler is not used in it?	
	b)	How regeneration improves the efficiency of gas turbine? Does it affect the turbine work?	
	c)	Why water tube boiler is preferred over fire tube boiler in power plant or large-scale applications?	
	d)	Write short note on centrifugal pump.	
	e)	Write short note on air vessel.	
Q. 2	a)	In a single stage impulse turbine the mean diameter of the blade ring is 1m and the rotational speed is 3000 r.p.m. The steam is issued from the nozzle at 300 m/s and nozzle angle is 20°. The blades are equiangular. If the friction loss in the blade channel is 19% of the kinetic energy corresponding to the relative velocity at the inlet to the blades, what is the power developed in the blading when the axial thrust on the blades is 98 N ?.	(10)
	b)	Explain any five mountings of boiler.	(05)
	c)	What is Euler's theory? What is the use of it in turbomachinery?	(05)
Q. 3	a)	Air is drawn in a gas turbine unit at 15°C and 1.01 bar and pressure ratio is 7:1. The compressor is driven by the H.P. turbine and L.P. turbine drives a separate power shaft. The isentropic efficiencies of compressor, and the H.P. and L.P. turbines are 0.82, 0.85 and 0.85 respectively. If the maximum cycle temperature is 610°C, calculate : (i) The pressure and temperature of the gases entering the power turbine. (ii) The net power developed by the unit per kg/s mass flow. (iii) The work ratio. (iv) The thermal efficiency of the unit. Neglect the mass of fuel and assume the following: For compression process C_{pa} = 1.005 kJ/kg K and γ = 1.4 For combustion and expansion processes; C_{pg} = 1.15 kJ/kg K and γ = 1.333.	(10)
	b)	Derive the condition for maximum efficiency of reaction turbine.	(05)
	c)	Illustrate working of Turbojet Engine.	(05)

Q. 4 a) A boiler generates 7.5 kg of steam per kg of coal burnt at a pressure of 11 bar, from feed water having a temperature of 70°C. The efficiency of boiler is 75% and factor of evaporation 1.15, specific heat of steam at constant pressure is 2.3. Calculate: (08)

(i) Degree of superheat and temperature of steam generated;

(ii) Calorific value of coal in kJ/kg;

(iii) Equivalent evaporation in kg of steam per kg of coal

b) What is degree of reaction? Prove that the degree of reaction for parson's Reaction turbine is 50%. (08)

c) What is cavitation in pump? (04)

Q. 5 a) A centrifugal pump has the following characteristics: outer diameter of impeller = 800 mm; width of impeller vanes at outlet = 100 mm; angle of impeller vanes at outlet = 40°. The impeller runs at 550 r.p.m and delivers 0.98 m^3 of water per second under an effective head of 35 m. A 500 kW motor is used to drive the pump. Determine the manometric, mechanical and overall efficiencies of the pump. Assume water enters the impeller vanes radially at inlet. (10)

b) Write short note on surging and choking of compressor. Explain it with the help of Pressure ratio versus Mass flow rate graph. (6)

c) Define equivalent evaporation of boilers and what the significance of it is. (4)

Q. 6 a) Design a Francis turbine runner with the following data: (10)

Net head H = 68 m;

speed N = 750 r.p.m;

output power P = 330 kW;

η_h = 94%;

η_o = 85 %;

flow ratio ψ = 0.15;

breadth ratio n = 0.1;

inner diameter of runner is half of outer diameter.

Also assume 6% of circumferential area of the runner to be occupied by the thickness of the vanes. Velocity of flow remains constant throughout and flow is radial at exit.

b) Write short note on compounding of Impulse turbine. (5)

c) What is priming? and why it is not required in reciprocating pump? (5)

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QP-10064909

3/12

(3 Hours) [Total Marks : 80]

N.B. 1) **Question No. 1 is compulsory**
2) Solve **Any Three** from remaining **Five** questions.
3) Use of standard data book like PSG, Mahadevan is permitted
4) **Assume** suitable data if necessary, giving justification

Q1 Answer **any Four** from the following

a) Why factor of safety is necessary in design of mechanical elements? Discuss the important factors influencing the selection of factor of safety. **5**

b) Explain overhauling of screw and self-locking of screw. **5**

c) What do you understand by stress concentration? How to minimize the stress concentration **5**

d) Discuss advantages and disadvantages of rolling contact bearings over sliding contact bearings **5**

e) Write a note on Nipping in a leaf spring **5**

Q2 a) Design a Socket and Spigot type of cotter join to transmit an axial load of 60 KN. Select suitable material, factor of safety and draw informative sketch. **15**

b) Explain the terms applied to rolling element bearing - 1) Rated life 2) Dynamic capacity 3) static capacity. **05**

Q3 a) A shaft is supported in bearings A and B, 1000 m apart. An involute spur gear having PCD 400 mm is located at 300 mm to the right of LH bearing and a 600 mm diameter pulley is mounted 350 mm to the left of RH bearing. The gear is driven by a pinion located vertically above, while the pulley transmits power via belt drive to a pulley located vertically below. The ratio of belt tension is 2.0. The pulley weighs 2500N. Design the shaft, if power transmitted is 30 KW at 400 rpm. The shaft rotates clockwise when viewed from A. **15**

b) Write note on – Criteria for material selection. **05**

Q4 a) A DGBB is to be selected for an intermediate shaft of helical gear box which is subjected to an axial load of 5 KN and radial load of 12 KN when operating at 600 rpm. Select suitable size of bearing if it is required to have a life of 20000 hours with a probability of survival of 92%. **10**

b) Following data is given for a 360^0 hydrodynamic bearing. **10**
Radial load = 10 KN, Journal speed = 1450 rpm, l/d ratio =1, bearing length = 50 mm, radial clearance = 20 microns, eccentricity = 15 microns. Calculate 1) the minimum oil film thickness 2) Coefficient of friction 3) Power lost in friction 4) Viscosity of lubricant in CP 5) total flow rate of lubricant in liters/minutes.

Q5 a) A single cylinder four stroke cycle internal combustion engine produces 15 KW power at 700 rpm. Design a suitable flywheel, assuming coefficient of fluctuation of speed as 0.04. The torque developed during the power stroke may be considered as sine curve and work done during the power stroke is 30% more than the work done per cycle. **10**

b) Calculate the factor of safety on breaking load for a chain $10A_2$ DR50 which is used to transmit 15 KW design power. The input speed is 960rpm and reduction ratio is 2.90. **10**

Q6 a) A close coil helical compression spring is subjected to an axial load varying from 5 KN to 6.5 KN at frequency of 20 cycle per second. The spring rate is 70 N/mm. Design the spring for a factor of safety 1.8. the properties of spring material are **15**

$S_u = \frac{2000}{d^{0.17}} MPa$ $S_{ys} = \frac{1200}{d^{0.17}} MPa$ $Sno = \frac{600}{d^{0.15}} MPa$ $G = 80000\ N/mm^2$

Where d is diameter of wire.

b) State different theories of failure and explain any two in details. **05**
