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End Semester Examinations - Nov-Dec 2015 Exams

14ME1003 Basic Mechanical Engineering

Set A

Time : 3 hrs
Total Marks: 100

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1. With neat sketch, explain the working of four stroke diesel engine.

OR

2. Explain the construction and working of Babcock and Wilcox boiler.Explain the construction and working of Babcock and Wilcox boiler.

3. Draw the layout of a thermal power plant. State its advantages and disadvantages.

OR

4. With neat sketch explain the nuclear power plant and list its limitations.

5. Explain the stress – strain curve for ductile materials.

OR

6. A tension test was conducted on a steel rod at strength of material laboratory and the following observation were made:

Initial Diameter = 14mm

Gauge length = 100mm

Load at yield point = 41.5KN

Maximum load applied = 69.2KN

Load at breaking = 61.6KN

Diameter at the neck = 11.2mm

Elongation at break= 38mm

Elongation at load 25.1 KN (P) = .08mm (dl)

Determine:

i.Young's modulus or Modulus of elasticity.

ii.Yield stress.

iii.Ultimate Stress.

iv.Nominal Stress at breaking.

v.Actual Stress at breaking.

vi.Percentage elongation.

vii.Percentage reduction in cross - sectional area.

7. Draw a neat sketch of cupola furnace and explain how cast iron is produced.

OR

8. Explain the mechanical properties of metals and alloys in detail.

9. Explain the principle parts of a centre lathe with a neat sketch.

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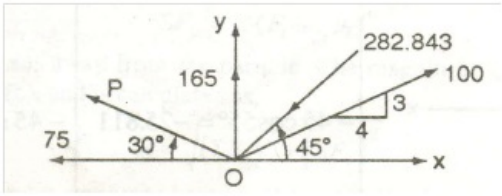
End Semester Examinations - Nov-Dec 2015 Exams

14ME2001 Engineering Mechanics

Set B

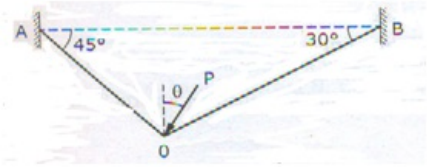
Time : 3 hrs
Total Marks: 100

1. Five forces in kN act on a particle as shown in Fig and the algebraic sum of horizontal components of all these forces is -324.9 kN. Calculate the magnitude of force 'P' and the resultant of all the forces. (20)

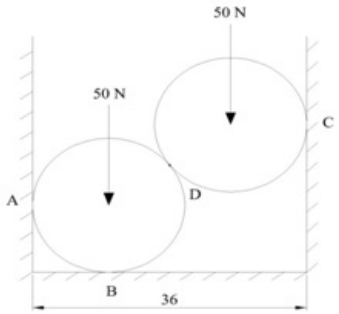


OR

2. A force P is applied at O to the string AOB as shown in the Fig. If the tension in each part of the string is 50 N, find the magnitude and direction of the force P for equilibrium conditions. (20)

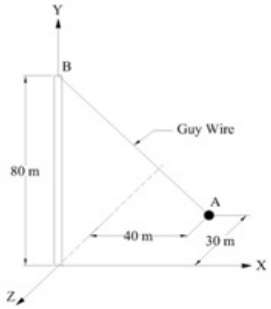


3. Two rollers, each weighing 50 N and of radius 10 cm rest in a horizontal channel of width 36 cm, as shown in the Fig. Find the reaction on the point of contacts A, B and C. (20)

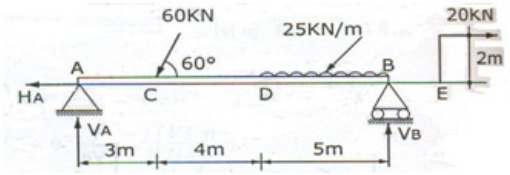


OR

4. A tower guy wire is shown in Fig . It is anchored by means of a bolt at A. The tension in the wire is 2500 kN. Determine (i) the components F_x, F_y and F_z of the force acting on the bolt, and (ii) the angles Θ_x, Θ_y and Θ_z defining the direction of the force. (20)

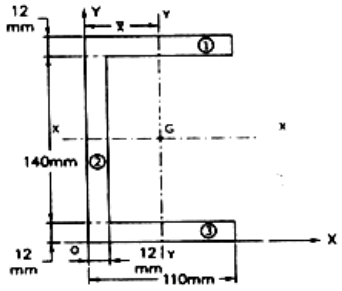


5. Find the reactions at supports A and B, for the beam shown in Fig. (20)

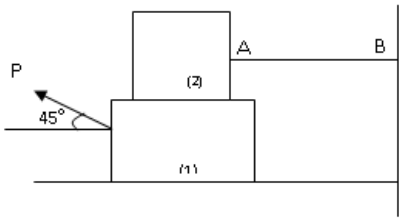


OR

6. Find the moment of inertia of the section shown in the Fig , about its centroidal axis. (20)



7. Block (2) rests on Block (1) and is attached by a horizontal rope AB to the wall. What force P is necessary to cause motion of block (1) to impend. The coefficient of friction between the blocks is 1/4 and between the floor and the block (1) is 1/3. Mass of blocks (1) and (2) are 14 kg and 9 kg respectively. (20)

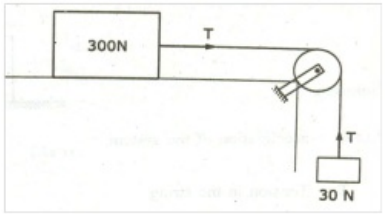


OR

8. (a). A motor moving with an uniform acceleration covers a distance of 20 m in 4 seconds and 40 m in 6 seconds. Find the uniform acceleration of the motor. (10)

(b) The equation of motion of a particle moving in a straight line with variable acceleration is given by, $s = 15t + 3t^2 - t^3$ in which, 's' is the distance measured in 'm' and the time 't' is measured in seconds. Calculate the (i) velocity and acceleration at the start (ii) time, at which the particle attains maximum velocity. (10)

9. The Fig shows a body of weight 300 N on a smooth horizontal plane, attached by a string to a 30 N weight, which hangs vertically. Find the acceleration of the system and the tension in the string using Newton's laws of motion. (20)



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End Semester Examinations - Nov-Dec 2015 Exams

14ME2003 Material Science and Engineering

Set A

Time : 3 hrs
Total Marks: 100

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1. Explain about the various defects that are present in crystal lattice with sketch. Write about the ways and means to eliminate these defects. (20)

OR

2. With neat sketch explain the working principle, capabilities and advantages of Scanning Electron Microscope and Tunneling Electron Microscope. (20)

3. List the all strengthening mechanism and explain any two with neat sketch and example. (20)

OR

4. Describe about the Fick's Laws (both the laws) of diffusion with examples. (20)

5. a. Explain about fatigue failure. (5)

   b. With illustrations, explain how S-N curve is helpful in predicting the fatigue life of a material? (15)

OR

6. Explain the Griffith's Crack propagation theory for ductile and brittle materials with neat sketch and example. (20)

7. a. Define Hardenability. (5)

   b. Explain the Jominy's end-quench test with neat figure. (15)

   c. Describe about the hardenability curves that result from the Jominy's end-quench test. (5)

OR

8. a. Explain the factors governing substitutional solubility. (15)

   b. Write about the Gibbs phase rule. (5)

9. a. Draw the Iron – Iron Carbide diagram and explain the different regions in it. (10)

   b. Describe the various interpretations that are possible with the Iron-Iron Carbide Diagram. (10)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2004 Manufacturing Processes

Set B

Time : 3 hrs
Total Marks: 100

1.	a.Briefly write about the types of moulding sand (10)	
	b.Explain about Shell casting process(10)	
	OR	
2.	a. Briefly write about the moulding sand properties (10)	
	b. Explain about Investment casting process (10)	
3.	a.Differentiate between hot and cold working process.(10)	
	b. Explain about Injection moulding process(10)	
	OR	
4.	a.Differentiate between open die and closed die forging (05)	
	b.What are the defects that are present in the rolling process(10)	
	c.Explain about drawing process(05)	
5.	a.In detail write about the operations that can be performed in sheet metal (20)	
	OR	
6.	a.In short write about the type of sheet metal dies (10)	
	b.Explain about clearance, and punching force calculation with respect to sheet metal (10)	
7.	Explain powder metallurgy process(20)	
	OR	
8.	Write about particle size, distribution and size blending (20)	
9.	Explain about TIG welding with neat sketches (20)	

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2005 Machining Processes

Set B

Time : 3 hrs
Total Marks: 100

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1. In orthogonal cutting, if the feed is 1.25mm/rev and chip thickness after cutting is 2mm. shear strength is 6000kg/cm^2 . Width of cut is 10mm with 10° rake angle, cutting speed and co-efficient of friction are 30m/min as well as 0.9. Determine (a) Chip thickness ratio (b) Shear angle (c) friction angle (d) shearing force

OR

2. Discuss the classification cutting process with an example.

3. Explain the construction and working of Centre Lathe with neat sketch.

OR

4. Explain single point cutting tool nomenclature with neat sketch .

5. What are all the Types of milling machine? Explain anyone of them with neat sketch.

OR

6. What is shaper? Explain the construction and working of the same with neat sketch.

7. What are all the Hole making operations? Explain it with suitable sketch.

OR

8. Explain with neat sketch: various shapes and sizes of grinding wheel used in manufacturing.

9. What is EDM? Explain its construction and working with suitable sketch

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2006 Metrology and Measurement Systems

Set A

Time : 3 hrs
Total Marks: 100

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1. Explain in detail, the different types of errors in measurement and their causes.

OR

2. a) Define Calibration. Explain the standard procedure of calibrating a metrological instrument. (14)

b) Write short note on readability of measuring instruments: How it affects the process of quality control? (6)

3. a) With neat sketch explain the construction and working of a vernier caliper: (14)

b) Explain the principle of working of a dial indicator (6)

OR

4. a) Explain the construction and working of plunger type dial indicator. List out its applications (14)

b) Discuss the steps involved in 'wringing of slip gauges' (6)

5. With relevant sketches explain any three methods of measuring the straightness.

OR

6. Describe the construction and working of Tomlinson surface meter.

7. Define effective diameter and explain how effective diameter of screw thread is measured using two wire method.

OR

8. Discuss the different types of errors which arise during the manufacture of screw thread:

9. **Compulsory:**

Explain the principle, construction and working of Laser interferometer. List out its applications.

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2014 Engineering Thermodynamics

Set A

Time : 3 hrs
Total Marks: 100

1. A piston and cylinder machine contains a fluid system which passes through a complete cycle of four processes. During a cycle, the sum of all heat transfers is –170 kJ. The system completes 100 cycles per min. Complete the following table showing the method for each item and compute the net rate of work output in kW**. (20 Marks)**

Process	Q (kJ/min)	W (kJ/min)	E (kJ/min)
a-b	1.	1.	•
•	1.	1.	•
c-d	–2,100	•	1.
•	•	•	•

OR

2. Air flows steadily at the rate of 0.5 kg/s through an air compressor, entering at 7m/s velocity,100 kPa and 0.19 m^3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of air entering. Cooling water in the compressor jackets absorbs heat from the air at the rate of 58kW (a) compute the rate of shaft work input to the air in kW (b) find the ratio of the inlet pipe diameter to outlet pipe diameter. **(20 Marks)**

3. A reversible heat engine operates between two reservoirs at temperatures of 600° C and 40° C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 40° C and –20° C. the heat transfer to the heat engine is 2000kJ and the net work output of the combined engine refrigerator plant is 360kJ. Evaluate the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40° C. **(20 Marks)**

OR

4. A fluid undergoes a reversible adiabatic compression from 0.5MPa, 0.2m^3 to 0.05m^3 according to the law, $pv^{1.3}$ = constant. Determine the change in enthalpy, internal energy and entropy and the heat transfer and work transfer during the process. **(20 Marks)**

5. Steam initially at 1.5MPa, 300°C expands reversibly and adiabatically in a steam turbine to 40° C. Determine the ideal work output of the turbine per kg of steam**.(20 Marks)**

OR

6. a. Draw the phase equilibrium diagram for a pure substance on T-S coordinates. **(12 Marks)**
   b. Find the enthalpy and entropy of steam when the pressure is 2MPa and the specific volume is 0.09 m^3/kg. **(8 Marks)**

7. A mixture of ideal gases consists of 3kg of nitrogen and 5kg of carbon dioxide at a pressure of 300kPa and temperature of 20^oC. Find a) a mole fraction of each constituent b) the equivalent molecular weight of mixture c) the equivalent gas constant of mixture d) the partial pressures and partial volumes e) volume and density of the mixture f) C_p and C_v of the mixture. Take γ for CO_2 and N_2 to be 1.286 and 1.4 respectively. **(20 Marks)**

OR

8. (a) A certain gas has C_p= 1.968 and C_v = 1.507 kJ/ kg.K. Find its molecular weight and the gas constant. **(10 Marks)**

   (b) The gas neon has a molecular weight of 20.183 and its critical temperature, pressure and volume are 44.5 K, 2.73 MPa and 0.0416m^3/kg mol. Reading from a compressibility chart for a reduced pressure of 2 and a reduced temperature of 1.3, the compressibility factor Z is 0.7. What are the corresponding specific volume, pressure, temperature and reduced volume?**(10 Marks)**

9. Atmospheric air at 1.0132 bar has a DBT of 32°C and a WBT of 26°C. Compute (a) the partial pressure of water vapour (b) the specific humidity (c) the dew point temperature (d) the relative humidity (e) the density of air in the mixture (f) the density of vapour in the mixture (g) the enthalpy of the mixture. **(20 Marks)**

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2015 Thermal Engineering I

Set A

Time : 3 hrs
Total Marks: 100

1. The following data have been collected during a boiler trial.

   Steam generated per kg of dry coal = 9.62 kg, steam pressure = 25 bar, steam temperature =350^{0}C, temperature of feed water =30^{0}C, Cp (super heated steam) = 2.1 kJ/kg K, Cp (flue gases) =1.1 kJ/kg K, mass of flue gases = 16.4 kg, temperature of flue gases =200^{0}C, boiler room temperature 20^{0}C. Determine the quantity of heat used to generate the steam and heat carried by hot flue gases per kg of fuel.

OR

2. Describe with a neat sketch the working of Bobcock and Wilcox boiler.

3. Derive an expression for the exit velocity of steam and discharge of steam through the nozzle.

OR

4. The inlet condition to a steam nozzle are 10 bar and 250^{0}C. The exit pressure is 2 bar. Assuming isentropic expansion and negligible inlet velocity determine (i) the throat area, (ii) exit velocity and (iii) exit area of the nozzle. Take mass flow rate of steam as 0.2 kg/s.

5. What is compounding of steam turbine? Explain velocity compounding with a neat sketch.

OR

6. Explain reaction turbine with a neat sketch.

7. Explain the construction and working of a single stage reciprocating air compressor with a neat sketch.

OR

8. A single stage reciprocating air compressor is required to compress 1 kg of air from 1 bar to 4 bar. The initial temperature is 27^{0}C. Compare the work requirement in the following cases.

   i. Isothermal compression, (ii) compression with $pv^{1.2}$=C and (iii) isentropic compression.

9. Explain vapour absorption refrigeration system with neat diagram.

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2016 Thermal Engineering II

Set A

Time : 3 hrs
Total Marks: 100

1. 1. (a) Describe the fuel injection system for diesel engines with neat sketch. (10 marks)

(b). Explain the water cooling system with neat sketch. (10 marks)

OR

2. 2. A four-stroke, four cylinder petrol engine develops 18 kW brake power at 3000 rpm. The diameter of the cylinder =65 mm, stroke of the engine = 95 mm, clearance volume = 65 cm^3, relative efficiency on BP basis = 50%, CV of fuel used = 46,000 kJ/kg and mechanical efficiency = 80%. Calculate the air standard efficiency, brake thermal efficiency and specific fuel consumption. (20 marks)

3. 3. Derive an expression for the air standard efficiency of Diesel cycle. (20 marks)

OR

4. 4. An engine is working on Otto cycle with a compression ratio of 7. The initial conditions of air are 303 K and 1.03 bar. The maximum temperature of the cycle is 1420 K. Calculate net work per kg of air, thermal efficiency, peak pressure, heat rejected per kg of air and the mean effective pressure. (For air: Cp = 1.005kJ/kgK, Cv = 0.718kJ/kgK and

R =0.287kJ/kgK) (20 marks)

5. 5. Draw a neat diagram of winter air conditioning system and explain. (20 marks)

OR

6. 6. The following data relates to the office air-conditioning plant having maximum seating capacity of 25 persons:

Outside design conditions	: 34^0C DBT and 28^0C WBT
Inside design conditions	: 24^0C DBT and 50% RH
Solar heat gain	: 9120 W
Sensible heat gain per person	: 90 W
Latent heat gain per person	: 105 W
Lightening load	: 2300 W
Sensible heat gain from other sources	: 11630 W
Infiltrated air	: 14 m^3/min

Assuming 40 % fresh air and 60 % recirculated air passes through the evaporator coil and the bypass factor is 0.15, find the Room sensible heat factor and dew point temperature of the coil.

(20 marks)

7. 7. (a) Air flowing in a duct has a velocity of 300 m/s, pressure 1.0 bar and Temperature 290 K.

Determine:

(a) Stagnation pressure and temperature,

(b) Velocity of sound in the dynamic and stagnation conditions,

(c) Stagnation pressure assuming constant density. (10 marks)

(b). Derive the Mach number variation relation for one dimensional isentropic flow. (10 marks)

OR

8. 8. The Mach number at the exit of a combustion chamber is 0.9. The ratio of the stagnant temperatures at exit and entry is 3.74.If the pressure and temperature of the gas at exit are 2.5 bar and 1000^0C respectively determine (a) Mach number, pressure and temperature of the gas at entry. (b) The heat supplied per kg of the gas and (c) maximum heat that can be supplied.

(20 marks)

9. 9. With neat sketch explain the constructional features and working principle of Turbojet Engine.

(20 marks)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2017 Basic Automobile Engineering

Set B

Time : 3 hrs
Total Marks: 100

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1. a. Describe the brief history of the automobile. (15)

   b. Describe briefly an Electronic Stability Program (5)

OR

2. Draw the layout of conventional Chassis with a neat diagram and explain about various parts on it and mention the various loads acting on the chassis frame.

3. Draw the Diesel cycle on p-V and T-s diagrams. Mark the various processes and explain them.

OR

4. a. What are the different types of Gaseous fuels used in automobile? Explain briefly. (16)

   b. In an SI engine working on the ideal Otto cycle, the compression ratio is 5.5 Calculate the air standard efficiency of the engine? Take γ =1.4 (4)

5. a. Explain with the help of sketches, the working of four stroke petrol engine. (16)

   b. Differentiate between two strokes and four stroke Engines. (4)

OR

6. a. Explain with the help of sketches, the working of two stroke diesel engine. (14)

   b. Define i) Clearance volume ii) Piston speed iii) Compression ratio. (6)

7. Explain Multi point fuel injection and CRDI system in detail with diagrams.

OR

8. Mention the various methods of cooling systems and explain forced circulation Cooling System with a neat sketch and also compare its advantages and Dis advantages.

9. Mention the various types of steering gearbox system and explain Re-circulating Ball & Rack and Pinion type Steering Gear in detail, with a neat sketch.

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2018 Power Plant Engineering

Set A

Time : 3 hrs
Total Marks: 100

1. Illustrate with a T-s plot a simple Rankine Cycle. Also, explain using separate T-s diagrams how is the efficiency of the cycle increased by a) increasing boiler pressure b)decreasing condenser pressure and c) superheating steam. (20 Marks)

OR

2. How is a Rankine cycle modified? Explain with T-s plots how the efficiency of power plants is enhanced using reheating and regeneration processes.(20 Marks)

3. a) Explain with a neat sketch power generation using a pressurized water nuclear reactor. (10 Marks)

   b) Draw T-s and p-v diagrams to elaborate the operation of open and closed cycle gas turbine power plants. (10 Marks)

OR

4. a) Air enters the compressor of a gas turbine power plant operating on Brayton cycle at 101.32 kPa, 27°C. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume turbine work to be 2.5 times the compressor work. Take γ=1.4. (14 Marks)

   b) Compute the air standard efficiency of a Brayton cycle operating between a pressure of 1 bar and a final pressure of 12 bar. Take γ=1.4 (6 Marks)

5. a) What is a surge tank? Why is it important in a hydro plant? Illustrate your answer. (4 Marks)

   b) What is the function of a draft tube? Explain with sketches different types of draft tubes. (6 Marks)

   c) Enumerate the advantages of gas turbine and diesel power plants.(10 Marks)

OR

6. a) What are the various components in a diesel power plant? Explain the layout with a neat sketch.(10 Marks)

   b) How are hydroelectric power plants classified according to the availability of head / quantity of water and nature of load?(10 Marks)

7. a) Explain with a neat sketch the magnetohydrodynamic concept of energy conversion. (14 Marks)

   b) Write brief notes on ‘energy audit’.(6 Marks)

OR

8. a) Define the following:i) Capacity Factor ii) Demand Factor and iii) Diversity Factor. (6 Marks)

   The loads on a power plant with respect to time for 24 hours are tabled below.

Time, Hrs	0 -6	6 - 8	8 - 12	12 - 14	14 - 18	18 - 22	22 - 24
Load, MW	40	50	60	50	70	80	40

   Construct the load curve and find load factor of the power station. If the loads above 60 MW are taken by a stand-by unit of 20 MW capacity, find the load factor and use factor of the stand-by unit.(14 Marks)

9. List out the major pollutants from coal based thermal power plants. Discuss briefly the methods employed for flue- gas desulfurization and particulate collection. (20 Marks)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2025 Computer Aided Design and Manufacturing

Set **Time : 3 hrs**
B **Total Marks: 100**

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1. How the CAD / CAM overlaid by product cycle? Explain with necessary sketch. (20)

OR

2. a. What are the various sections in IGES? Explain with suitable example. (10)

   b. How the computers are helpful in geometric modeling, engineering analysis and design evaluation in design process? (10)

3. a. Describe DDA Line drawing Algorithm. Also calculate and sketch the pixels for a line drawn from (4, 4) to (12, 14). (15)

   b. What is transformation? How many types of transformations ae there to change the geometry? (5)

OR

4. a. Write a short note on Hidden line removal. (10)

   b. Write a short note on Hidden surface removal. (10)

5. a. Difference between wireframe, solid and surface modeling and discuss the applications of CAD/CAM in any automobile industry. (10)

   b. Explain Hermite curve with neat sketch. (10)

OR

6. Write short note on CSG and B-rep. (20)

7. a. Briefly discuss the following NC motion control systems with neat sketch. (10)

   i. Point -to-point

   ii. Straight cut

   iii. Contouring

   b. Explain the types CNC machining centers with sketch and distinguish the features. (10)

OR

8. a. Explain open loop system and closed loop system of numerical control. (10)

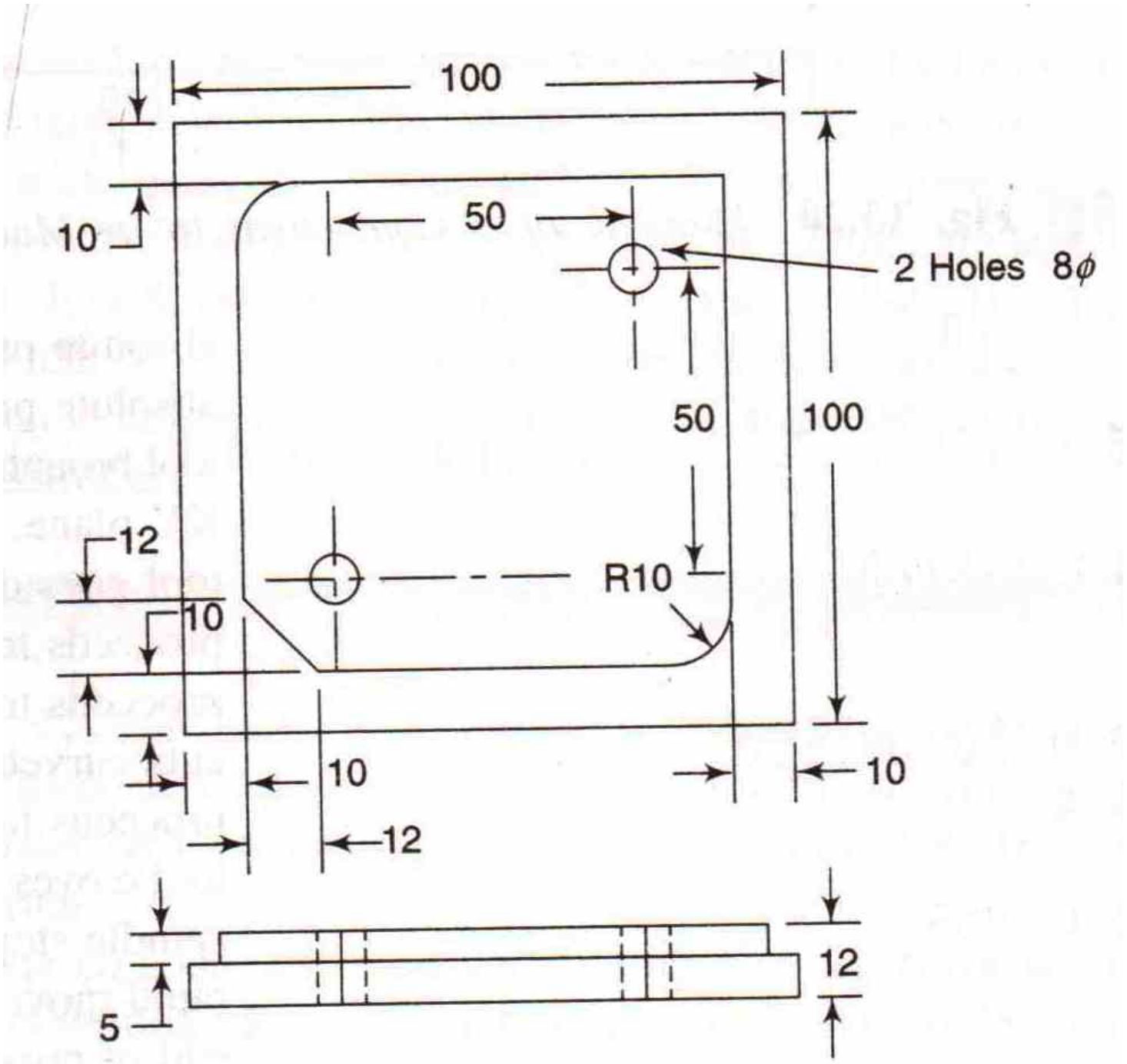
   b. Write short notes on

   i) Subroutines ii) Looping and Jumping (10)

9. Compulsory.

   a. Enumerate the advantages of Computer Assisted Part Programming when compared to Manual Part Programming. (10)

   b. Write the part program for the component shown in figure. (10)



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End Semester Examinations - Nov-Dec 2015 Exams

14ME2026 Mechanics of Machines

Set B

Time : 3 hrs
Total Marks: 100

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1. Sketch and explain the various inversions of four bar chain.

OR

2. Sketch and explain any three inversions of a single slider crank chain.

3. The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine: 1. velocity of piston, 2. angular velocity of connecting rod and 3. velocity of point E on the connecting rod 1.5 m from the gudgeon pin.

OR

4. In an engine mechanism, the crank CB = 100 mm long and the connecting rod BA = 300 mm with centre of gravity G, which is 100 mm from B. The crank is turned 120° from inner dead centre (i.e. angle ACB = 120°). The crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2. Find: 1. velocity of G and angular velocity of AB, and 2. acceleration of G and angular acceleration of AB.

5. Explain with sketches the different types of cams and followers.

OR

6. A cam is to give the following motion to a knife-edged follower : 1. Outstroke during 60° of cam rotation; 2. Dwell for the next 30° of cam rotation; 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft,

7. A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine 90 rpm, find the power absorbed in friction at the thrust block, assuming l. uniform pressure; and 2. Uniform wear.

OR

8. In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B?

9. **Compulsory**

A multiple disc clutch has five plates having four pairs of active friction surfaces. If the intensity of pressure is not to exceed 0.127 N/mm^2, find the power transmitted at 500 r.p.m. The outer and inner radii of friction surfaces are 125 mm and 75 mm respectively. Assume uniform wear and take coefficient of friction = 0.3.

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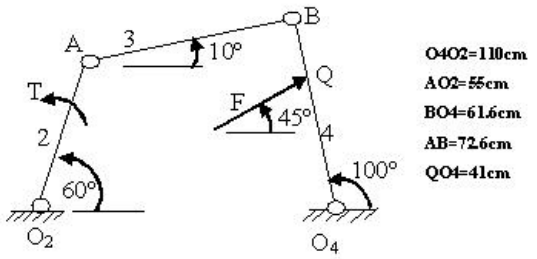
End Semester Examinations - Nov-Dec 2015 Exams

14ME2027 Dynamics of Machinery

Set A

Time : 3 hrs
Total Marks: 100

1. The four-bar linkage has crank 2 driven by torque **T** ; an external load F=100 N at an angle of 45º on link 4. For the particular position of the linkage shown find the value of torque **T,** all the constraint forces and their reactions necessary for this linkage to be in a position of equilibrium. (Marks 20)



(OR)

OR

2. **(a)** Write the equation for piston effort for the following cases. Explain briefly with a sketch. (Marks 8)

(i) horizontal reciprocating engine

(ii) vertical reciprocating engine

(b) The stroke of a steam engine is 500mm and the length of the connecting rod is 1.25m. The crank rotates at 240 r.p.m. Determine: (i) velocity and acceleration of the piston, when the crank has travelled through an angle of 60° from inner dead centre, and (ii) the position of the crank for zero acceleration of the piston. (Marks 12)

3. **(a)** Define the following: (Marks 4)

(i) Coefficient of fluctuation of energy

(ii) Coefficient of fluctuation of speed

(b) The turning moment diagram for a multi-cylinder engine has been drawn to a scale 1mm=600N-m vertically and 1mm = 4º horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows: +342, -23, +245, -303, +115, -232,+227 and -371 mm^2 , when the engine is running at a speed of 150r.p.m. If the radius of gyration is 1 m the and the total fluctuation of speed is not to exceed ± 2% of the mean speed, find mass of the flywheel. (Marks 16)

(OR)

OR

4. The turning moment diagram for a multi-cylinder engine has been drawn to a scale of 1 mm to 500 N-m torque and 1 mm to 6° of crank displacement. The intercepted areas between output torque curve and mean resistance line taken in order from one end, in sq. mm are – 30, + 410, – 280, + 320, – 330, + 250, – 360, + 280, – 260 sq. mm, when the engine is running at 800 r.p.m. The engine has a stroke of 300 mm and the fluctuation of speed is

not to exceed ± 2% of the mean speed. Determine a suitable diameter and cross-section of the flywheel rim for a limiting value of the safe centrifugal stress of 7 MPa. The material density may be assumed as 7800 kg/m^3. The width of the rim is to be 5 times the thickness. (Marks 20)

5. **(a)** Explain primary and secondary unbalanced forces of reciprocating parts of an engine mechanism. (Marks 6)

(b) Four masses m_1, m_2, m_3 and m_4 are 160 kg, 260 kg, 200 kg and 220 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°, 90° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.15 m. (Marks 14)

(OR)

OR

6. **(a)** Find the equivalent stiffness of four springs connected

(i) in series

(ii)in parallel.

Stiffness value of each spring is 10kN/m. Comment on the results. (Marks 4)

(b) Mass of a single degree damped vibration system measures 6 kg and makes 25 free oscillations in 11 seconds. The amplitude of vibration reduces by 25% of its initial value after 5 oscillation. Determine (i) Stiffness of spring (ii) Logarithmic decrement (iii) Damping factor (iv) Critical damping coefficient and (v) actual damping coefficient. (Marks 16)

7. **(a)** What are the bad and good effects of vibration? (Marks 4)

(b) A mass attached to a spring of stiffness 550 N/m has viscous damping device. When the mass was displaced and released , the period of vibration was found to be 1.8 sec., and the ratio of consecutive amplitudes was 5:1. Determine the amplitude and the phase angle when a force F= 6sin4t N acts on the system. (Marks 16)

(OR)

OR

8. **(a)** Derive the length of a torsionally equivalent shaft (Marks 6)

(b) A shaft 1.7m long is 100 mm in diameter for the first 0.7 m of its length, 60 mm in diameter for the next 0.5 m of the length and 50 mm in diameter for the remaining length. The shaft carries two rotors at two ends, the first having a mass of 750 kg and 0.9 m radius of gyration located at the 100 mm diameter end and the second having a mass of 600kg and 0.6 m radius of gyration located at the other end. Determine the location of the node and natural frequency of torsional vibration of the system Take rigidity modulus C=80GN/m^2.
(Marks 14)

9. **(Compulsory Question)**

(a) Make comparisons between a governor and a flywheel. (Marks 2)

(b) Sketch a Watt governor and indicate the following (Marks 4)

(i) Height of a governor

(ii) Radius of rotation

(iii) Sleeve lift

(c) In the Watt's governor, length of each arm is 300 mm and they are pivoted on the axis of rotation. Determine the governor height and the radii of rotation of the balls, when the governor speed is 100 r.p.m. (Marks 4)

(d) A Porter governor has two balls each of mass 4 kg and a central load of 15 kg. The arms are all 200 mm long, pivoted on the axis. If the maximum and minimum radii of rotation of the balls are 140 mm and 100 mm respectively, find the minimum and maximum speeds and the range of speed. Use suitable sketch. (Marks 10)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME2029 Design of Machine Elements

Set B

Time : 3 hrs
Total Marks: 100

1. a. What are the different phases of the design process (2)

   b. Define principal plane and principal stress (3)

   b. A hollow shaft is required to transmit 600 kW at 110 rpm. The maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and twist in a length of 3m not to exceed 1.4 degrees. Find the external diameter of the shaft, if the internal diameter to the external diameter is (3/8). Take modulus of rigidity as 84 GPa. (15)

OR

2. a. State any three theories of failure and their applications (10)

   b. Explain size factor and surface finish factor in endurance strength. (5)

   c. Define stress concentration and stress concentration factor.Explain the various methods of relieving the stress Concentration. (5)

3. a. A Circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic loads having a minimum value of 20 kN and maximum value of 50 kN. Determine the diameter of the bar by factor of safety 1.5, size factor 1.85 and surface finish factor 0.9. The material properties of bar are given as ultimate strength: 650 MPa, Yield strength: 500 MPa, Endurance Strength: 350 MPa (15)

   b. Write short notes on the Leaf spring and its function with a neat diagram (5)

OR

4. a. A truck spring has 12 leaves, 2 of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with permissible shear stress of 280 MPa. Determine the thickness and width of the steel spring leaves. The ratio of total depth to the width of spring is 3. Also determine the deflection of the spring. (10)

   b. Design a helical compression spring for a load range of 2.0 to 2.5kN and deflection for this range being 5.0 mm. Spring index is Modulus of rigidity is 84kN/mm^2. permissible shear stress is 400N/mm^2. (10)

5. a. Design a rectangular key for a shaft of 50 mm diameter. Shear stress and crushing stress for the key material are 42 MPa and 70 MPa respectively. (3)

   b. What are the aggreable dimensions for a muff coupling (2)

   c. Design a flexible flange coupling of bush type to transmit 3 kW power at 960 rpm with a service factor of 1.2. Assume design stresses as follows: for shaft, pin, key- in shear 50 N/mm^2, for coupling- in shear 20 N/mm^2. for key- in crushing 100 N/mm^2. for bushes- in bearing 2 N/mm^2. (15)

OR

6. A shaft rotating at 720 rpm is supported between two bearings 80 cm apart. It carries two pulleys A and B at a distance of 30 cm and 60 cm respectively from the left bearing. 10 kW of power is fed into pulley A with diameter 40 cm and taken out at the pulley B with diameter of 30 cm by vertical belt drives having the same ratio of driving tensions which was observed to be 2.5. Assume the following working stresses. Bending stress: 75 N/mm^2 and shear stress: 45 N/mm^2. Design the diameter of the shaft. (20)

7. A Knuckle joint transmits an axial load of 70 kN for the following stresses: in tension 60 N/mm^2, in

compression 75 N/mm^2 and in shear 40 N/mm^2. Design and Sketch the knuckle joint. (20)

OR

8. a. Specify the types of pipe joints which are commonly used in engineering practice. (3)

b. How welded joints differs from the riveted joints (2)

c. Design a socket and spigot cotter joint to transmit a load of 50 kN. Assume the allowable design stresses as follows: in shear 45 N/mm^2, in tension 60 N/mm^2 and in crushing 100 N/mm^2. (15)

9. a. What is the main function of a crankshaft? (2)

b. Define slenderness ration. Explain its significance in the design of connecting rod. (3)

c. Determine the suitable dimensions of a Cast Iron flywheel rim of a multi cylinder engine which runs at a constant load with a speed of 600 rpm. While drawing the turning moment diagram to a scale of 1cm = 2500 N-m and 1cm= 30º, the area above and below the mean torque line in cm^2 are as follows: +1.6, -1.72, +1.68, -1.91, +1.97, -1.62. The speed is to be kept within $\pm$ 1% of mean speed of the engine. Assume suitable proportions in finding the dimensions of the flywheel rim. (15)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3005 Computer Integrated Manufacturing Systems

Set A

Time : 3 hrs
Total Marks: 100

1. a. How do various departments of an industry get benefited by Computer Integrated Manufacturing approach? Explain with a neat block diagram. (13)

   b. List the advantages, limitations and difficulties in implementing CIM in a conventional setup. (7)

OR

2. Differentiate between ERP and MRP. Explain the process of an ERP system with a neat sketch. List the advantages and disadvantages of the ERP system. (20)

3. Why does planning and scheduling play a major role in a company's output? List the necessity to have a Computer aided process planning system. (20)

OR

4. a. List the importance of an automatic inspection system. (5)

   b. Explain how machine vision system is used in inspection system with a neat sketch. (10)

   c. List the applications, advantages and disadvantages of machine vision system. (5)

5. a. What is an automated guided vehicle? Explain the working principle of automated guided vehicles with a neat sketch. (10)

   b. With a case study explain the application of automatic storage and retrieval system (ASRS) is required in an industry? (10)

OR

6. a. List the departments involved in concurrent engineering process. Mention how Group technology influences concurrent engineering. List the advantages and disadvantages of it. (10)

   b. Differentiate between cellular manufacturing and flexible manufacturing. Explain their working principle, advantages and applications. (10)

7. List the steps involved in Rapid Prototyping and explain with neat sketch. Explain Stereolithography process to develop 3D prototype, advantages, limitations, applications and process parameters affecting the process. (20)

OR

8. Describe about AI and Expert system. Mention how AI and Expert systems is used in CIM environment. (20)

9. Differentiate between CNC and DNC system. Explain the working principle of DNC system with a block diagram. How does DNC helps in implementing CIM in an industry? List the applications and advantages. (20)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3006 Computer Applications in Design

Set A

Time : 3 hrs
Total Marks: 100

1. Derive DDA line algorithm (10)

   Derive Circle algorithm (10)

OR

2. 1. Explain the working of following graphic displays

   (a)Direct View Storage Tube (DVST)(b)Vector refresh(c)Raster refresh

3. Translate the triangle in space in **2 units** in the **X** direction and **5 units** in the **Y** direction.

   Scale the original triangle by a factor of **1.5** in the **X** direction and **3** in the **Y** direction.

   Rotate the original triangle by **45^o** about the origin.

   Scale the original triangle by a factor of **1.5**androtate by **30^o** about the origin

OR

4. 1. Discuss the requirements and applications of interactive programming (20)

5. 1. a.Explain the concept of hidden line removal. (6)

   b.Describe the following visibility techniques:(2 x 7)

   i) Minimax testii) Homogeneity test

OR

6. 1. What is assembly modeling.With an example explain bottom up and Top down assembly approach (20)

7. i. Write short notes on Gourard shading and Phong's shading (10)
   ii. Classify the methods of tolerance analysis (10)

OR

8. 1. What is the need for modeling of curves and surfaces? Explain the parametric representation of Bezier curves (20)

9. 1. Mention the broad scope of STEP format. (7)

   Explain in detail the sections of IGES file. (13)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3007 Engineering Materials and Applications

Set B

Time : 3 hrs
Total Marks: 100

1. (a) A specimen of a 4340 steel alloy with a plane strain fracture toughness of 54.8 MPa √m is exposed to a stress of 1030 MPa. Will this specimen experience fracture if it is known that the largest surface crack is 0.5 mm long ? Explain in detail the theory behind . Assume that the parameter *Y* has a value of 1.0. (12)

(b) With help of a graph and suitable example explain the Ductile-to-brittle transition of materials . (8)

OR

2. (a) Some aircraft component is fabricated from an aluminum alloy that has a plane strain fracture toughness of 40 Mpa √m .It has been determined that fracture results at a stress of 300 MPa when the maximum (or critical) internal crack length is 4.0 mm. For this same component and alloy, will fracture occur at a stress level of 260 MPa when the maximum internal crack length is 6.0 mm? Why or why not? Assume Y value as 1.Also explain the technical reason for such incident. (12)

(b) Write the relation between the stress intensity & stress intensity factor and explain the stress intensity in details . (8)

3. (a) With help of a block diagram explain the sequence of brittle fracture process in detail and write the difference between brittle fracture and ductile fracture. (12)

(b) Show the various modes of crack surface failures with help of sketches and explain in detail. (8)

OR

4. (a) Draw the stress-strain-temperature data exhibiting the shape memory effect for a typical NiTi SMA and describe the transformation of phases in detail.(12)

(b) Draw the characteristics of amorphous materials and compare it with glass, ceramic and metals .Also write the manufacturing process of obtaining amorphous materials from the raw materials .(8)

5. (a) Using the creep curve ,explain three stages of creep .What is the effect of temperature on these stages? (10).

(b) Write the Griffith equation and explain the Griffith theory of brittle fracture .(5)

(c) Explain with graphs and suitable diagrams the mechanisms of fatigue failure and the status of ferrous and non ferrous materials under fatigue loading.(5)

OR

6. (a) With help of a block diagram describe the process involved in obtaining Maraging Steel , explain its physical properties and heat treatment cycle.(12)

(b) Write the methods of preparation of metallic glasses with suitable diagrams ,explain the properties and characteristics of metallic glasses.(8)

7. (a) List out the types/groups of silicate ceramics and write the properties and application of silicate ceramics.(7)

(b) Write the history of evolution of diamond, general properties & physical properties and its characteristics in detail .(7)

(c) Mention the structure, compositions , properties and applications of ceramics.(6).

OR

8. (a) Sate and explain with suitable example the energy balance between enthalpy and entropy when a rubber is subjected to stretch and contract.(12)

(b) Explain the status of availability of carbon in the earth, its applications and compare its properties with graphite and metals.(8)

9. (a) With suitable diagrams explain the various mechanisms of plastic deformation in detail.(10)

(b) Show the Goldie caterpillar analogy with help of diagrams and explain the concept of slip with out dislocation and with dislocation.(5)

(c) With help of a neat sketch explain the type of stress acting and leads to slip in a real single crystal .(5)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3008 Advanced Strength of Materials

Set A

Time : 3 hrs
Total Marks: 100

1. The state of stress at a point relative to an xyz coordinate system is given by the stress matrix

$$[\sigma] = \begin{bmatrix} -8 & 6 & -2 \\ 6 & 4 & 2 \\ -2 & 2 & -5 \end{bmatrix} \text{MPa}$$

Determine the state of stress on an element that is oriented by first rotating the xyz axes 45º about the z axis and then rotating the resulting axes 30º about the new x axis.[20 marks]

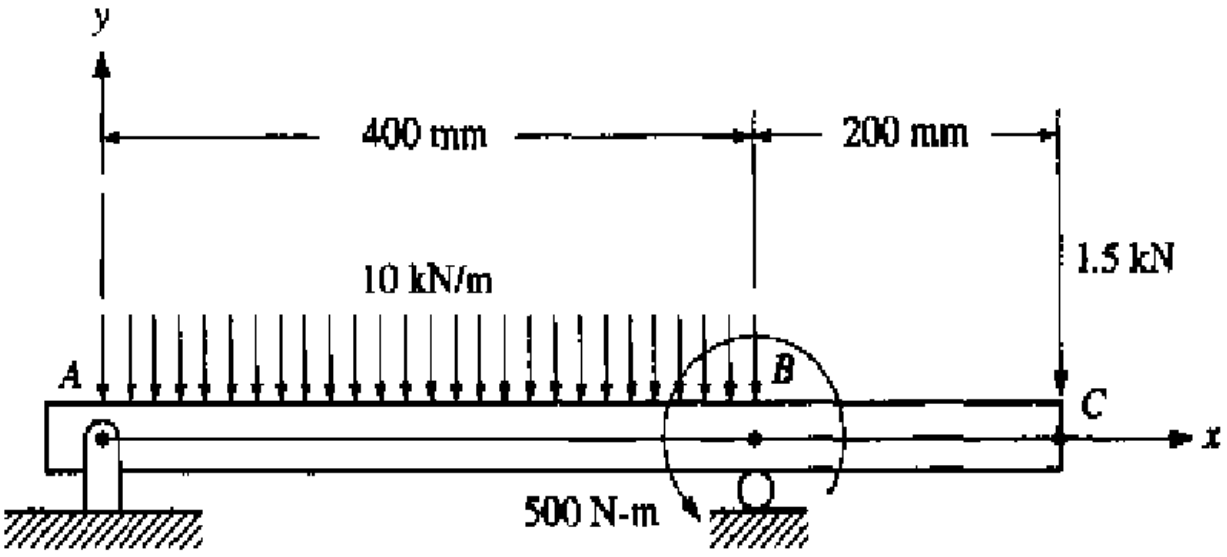
OR

2. The state of stress at a particular point relative to xyz coordinate system is given by the stress matrix

$$[\sigma] = \begin{bmatrix} 14 & 7 & -7 \\ 7 & 10 & 0 \\ -7 & 0 & 35 \end{bmatrix} \text{MPa}$$

Determine the normal stress and the magnitude and direction of the shear stress on a surface intersecting the point and parallel to the plane given by the equation 2x-y+3z=9.[20 marks]

3. Determine the shear force and bending moment equations for the figure given below and plot the results.[20 marks]



OR

4. Determine the stress fields that arise from the following stress functions using airys stress function principle

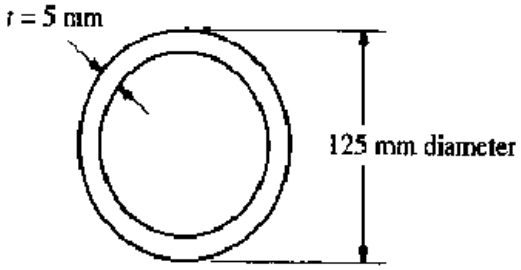
   1. $\phi = Cy^2$[10 marks]
   2. $\phi=Ax^2+Bxy+Cy^2$ [10 marks]

5. A solid circular shaft of radius r_o is transmitting a torque T. Determine the corresponding shear-stress distribution using pradtls stress function principle. [20 marks]

OR

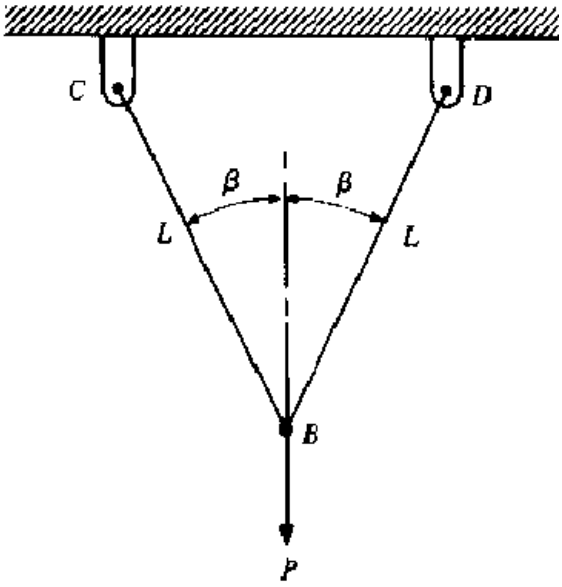
6. Determine the stress distribution in a cylinder with an inner diameter of 2 cm and outer diameter of 6 cm with internal pressure of 5000 Mpa and negligible external pressure. [20 marks]

7. Estimate the shear stress and total angle of twist of the thin walled circular cylinder shown in the figure. The steel tube is 0.5 m long and is transmitting a torque of 1 kN.m. The material constants are E = 200GPa and poissons ratio is 0.29. [20 marks]

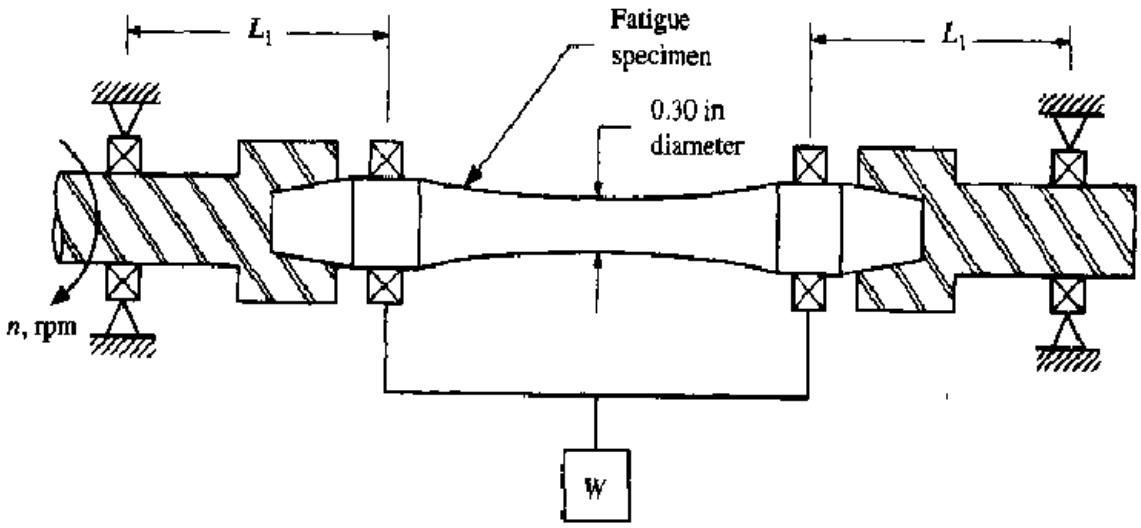


OR

8. Two cables shown in the figure are made of a non linear material whose stress strain behaviour is $\sigma = E\varepsilon - K\varepsilon^2$, where E = 30MPa and K = 10 GPa. The cross sectional area A of each cable is 0.2 cm^2, and both have a length L of 5 m and angle of inclination with vertical is 30°. Determine the vertical deflection of point B after a load of 2 kN is applied.[20 marks]



9. 1. Write short notes on fatigue strength and endurance limit. [10 marks]
   2. Estimate the life of a steel fatigue specimen with a force 186 N and length 2 cm. The material has an ultimate strength of 100 kPa and an endurance limit of 48 kPa. [10 marks]



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End Semester Examinations - Nov-Dec 2015 Exams

14ME3016 Advanced Metrology

Set B

Time : 3 hrs
Total Marks: 100

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1. a) Discuss the terms used for rating instrument performance. (10)

   b)What do you mean by 'calibration of measuring instruments'? What are the general guidelines for calibrating the instruments? (10)

OR

2. a) Explain in detail the basic components of coordinate measuring machine? (15)

   b) Explain how the isometric viewing method is used to find the surface defects. (5)

3. a) Explain the working principle of laser interferometer with a neat sketch. (15)

   b) State the applications of laser interferometer. (5)

OR

4. What is machine vision system? Discuss in detail about the basic steps involved in machine vision system. (20)

5. Explain in detail the construction and working of Scanning Electron Microscope with a neat diagram. State its advantages, limitations and applications. (20)

OR

6. What is machine tool metrology? Describe the various alignment tests performed on lathe with neat sketches. (20)

7. What is Ball Bar? Explain in detail how it is used for testing the accuracy of machine tool with neat sketch. (20)

OR

8. a) Discuss the various elements of surface texture. (5)

   b) Explain the working principle of Tomlinson surface meter with a neat diagram. (15)

9. Discuss unilateral and bilateral system of writing tolerances with suitable example and explain which system is preferred in interchangeable manufacturing and why?

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3019 Energy Conservation and Management

Set B

Time : 3 hrs
Total Marks: 100

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1. Differentiate between energy conservation and energy efficiency with suitable illustrations

OR

2. Discuss about the energy use patterns in India

3. Classify energy audit and discuss about it

OR

4. Discuss about the energy conservation in buildings

5. A 6 pole, 415 volt, 3 phase, 50 Hz induction motor delivers 22 kW power at rotor shaft at a speed of 950 rpm with PF of 0.88. The total loss in the stator including core, copper and other losses, is 2 kW. Calculate the following.

   i) Slip

   ii) Rotor Copper Loss

   iii) Total Input to motor

   iv) Line current at 415 V and motor pf of 0.88

   v) Motor operating efficiency

OR

6. Explain the methodology of refrigeration plant audit

7. Calculate the internal rate of return for the following cash flow of a project. Assume the investment to be Rs. 5,00,000 and the discount rate to be 11%

Year	1	2	3	4	5	6
Cash flow (Rs)	1,20,000	1,15,500	1,30,000	1,16,500	1,17,250	2,00,000

OR

8. Discuss about the simple pay back period and net present value method with examples

9. List out (any 6) checklists and tips for energy conversation in pumps, fans and blowers

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3020 Advanced Manufacturing Processes

Set A

Time : 3 hrs
Total Marks: 100

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1. Using line sketch, describe the main components of a WJM system. Also discuss about the advantages and disadvantages of the process. (20)

OR

2. Discuss in detail about the mechanism of metal removal in electro chemical machining process and state its application and advantages. (20)

3. a) Explain using a neat sketch the principle of material removal in EDM. (10)

   b) State the various materials used as tool electrodes for EDM. What are their typical applications? (10)

OR

4. a) Explain various parameters that influence the performance of chemical machining process. (15)

   b) Discuss the applications of chemical machining process. (5)

5. a) Describe the fabrication of cantilever using bulk micromachining technique with neat sketches. (12)

   b) Compare the difference between bulk and surface micromachining processes. (8)

OR

6. Describe various steps in LIGA process with a neat block diagram. State its capability and advantages over other micromachining processes. (20)

7. a) What is multi chip module? Explain about the types of MCM with theirs merits and demerits. (15)

   b) Write short notes on the printed circuit board. (5)

OR

8. a) Explain the basic steps in solid free form fabrication. (5)

   b) Describe the process of stereo lithography with neat sketch. (15)

9. a) Explain the method of fabricating SAW devices. (12)

   b) Write short notes on Application Specific Integrated circuit (ASIC). (8)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3021 Composite Materials

Set A **Time : 3 hrs**
Total Marks: 100

1. i) Compare any four Fiber Mechanical properties in detail (10)

   ii) Explain in detail the classifications of composite Materials? (10)

OR

2. i) Explain in detail the types of Matrix (12)

   ii) What are the Applications of composite materials in Engineering field? (8)

3. Derive the Elastic Moduli of composite for following conditions

   i) Longitudinal loading (5)

   ii) Transverse loading (8)

   iii) Shear loading (7)

OR

4. i) What are the types and Characteristic of Metal matrix composites? (10)

   ii) What are the advantages and limitations of Metal matrix composites? (10)

5. i) Explain in detail the design elements of composite materials (10)

   ii) How did you design the composite material for reducing the vibration in Aircraft wing? (10)

OR

6. Briefly describe any two Manufacturing methods of composite Materials (20)

7. i) Define Micromechanics and Macro mechanics of composite Materials (5)

   ii) Describe in detail the Characteristic and strength of lamina (15)

OR

8. i) Explain in detail the Mechanical behavior of Hybrid Composites (10)

   ii) Explain in detail PMC Process (10)

9. i) Explain in detail with suitable diagram how fatigue load acting on a structural part of Aircraft wing (5)

   ii) Briefly explain the Fatigue and Fracture behavior of composite Materials (15)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3026 Advanced Mechanism Design

Set B

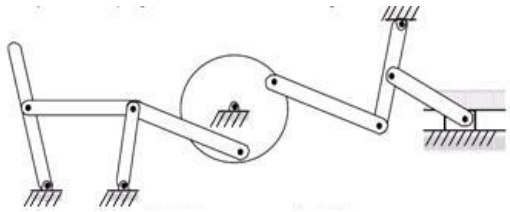
Time : 3 hrs
Total Marks: 100

1. a. Explain Kutzbach criterion for the mobility of planar mechanisms. (Marks 4)

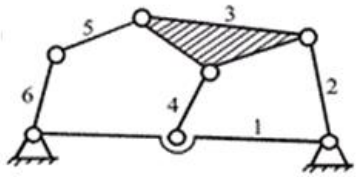
b. What are the types of joints used in mechanisms? (Marks 4)

c. Determine the mobility of the following mechanisms. (Marks 6 + 6)

(i)



(ii)



(OR)

OR

2. a. Explain with examples the four inversions of the slider-crank mechanism. (Marks 10)

b. What is Grashof's law? Explain Grashof's law with reference to the four inversions of the crank-rocker mechanism. (Marks 10)

3. Derive the relation for angular orientation of coupler (θ_3) and rocker (θ_4) in terms of link length of crank (a), coupler (b), rocker (c) , ground link (d) and crank angle (θ_2) of a crank-rocker mechanism using vector loop closure equation. (Marks 20)

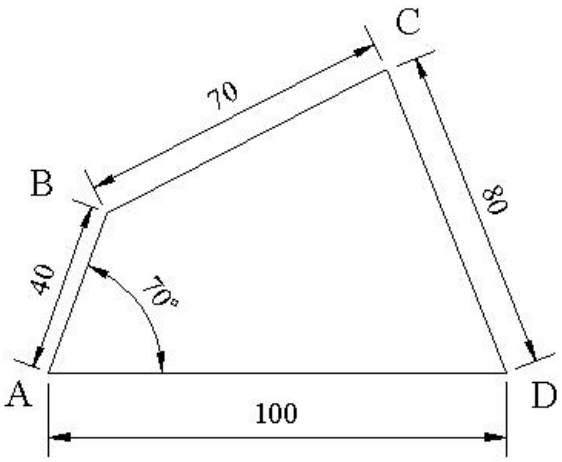
(OR)

OR

4. a. Apply Kennedy's rule to find the instantaneous centres of the crank-slider mechanism shown in part b. (Marks 6)

b. Angular velocity of crank AB is 500 r.p.m. Dimensions are given in mm.

Find the velocity of point B, C and mid-point of links AB, BC and CD using instantaneous centre method. AD is ground link. (Marks 14)



5. a. Sketch the locus of the moving centrode of a four-bar crank-rocker mechanism. (Marks 4)

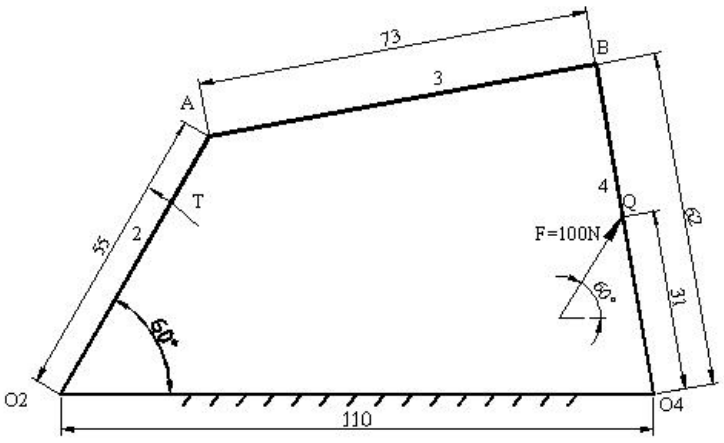
b. Obtain the relation for the position and angular velocity of coupler and slider of a four-bar slider-crank mechanism using vector loop closure equation. Angular velocity of crank is ω_2. Slider is offset by '**d**' from X-axis. (Marks 16)

(OR)

OR

6. a. State and explain D'Alembert's principle of dynamic equilibrium. (Marks 2)

b. A four-bar mechanism is subjected to external force and torque as shown below. Determine the torque T on the input link O2A for static equilibrium. (Marks 18)



7. a. How structural error and branch defect affect the function of a mechanism? (Marks 4)

b. Design a linkage to generate the function $y=\log_{10} x$ over the range $1 \leq x \leq 2$.

Choose $\theta_0 = 75°$, $\Delta\theta = 60°$ and $\varphi_0 = 30°$, $\Delta\varphi = 60°$ (Marks 16)

(OR)

OR

8. a. Explain Chebychev spacing of precision points. (Marks 4)

b. Synthesize a four-bar linkage to give the following values for the angular velocities and angular accelerations using Bloch's method.

$\omega_2 = 200$ rad/s, $\omega_3 = 85$ rad/s, $\omega_4 = 130$ rad/s, $\alpha_2 = 0$ rad/s^2 , $\alpha_3 = -1000$ rad/s^2 $\alpha_2 = -16000$ rad/s^2
(Marks 16)

9. **(Compulsory Question)**

a. Explain Denavit – Hartenberg parameters (Marks 12)

b. Discuss the topological arrangements of robotic arms. (Marks 8)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3031 Cogeneration and Waste heat Recovery Systems

Set B

Time : 3 hrs
Total Marks: 100

1. In a cogeneration plant 2800 kg/s of steam at 80 bar, 480°C expands in the high pressure turbine to 10 bar. From the exhaust 1500 kg/s of steam is extracted for process heating. The remaining steam expands in the low pressure turbine to 0.08 bar. Saturated liquid at 0.08 bar leaving the condenser is pumped to 9.5 bar where it mixes with the condensate from the process heater leaving at 9.5 bar, 120°C. The entire flow is then pumped to 80 bar. The isentropic efficiency of the turbine and pumps are 86% and 80% respectively. Determine

   i) the heat load (10 marks)

   ii) the power developed by the turbine (10 marks)

OR

2. Explain the working principle of a trigeneration system with a sketch? (10 marks)

   Explain the working principle of an organic Rankine cycle with a sketch? (10 marks)

3. It is proposed that the exhaust gas from a diesel powered electric generation plant be used to generate steam in a shell and tube heat exchanger with one shell and one tube pass. The steel tubes have a thermal conductivity of 40 W/m.K, an ID of 50 mm and a wall thickness of 4 mm. The exhaust gas, whose flow rate is 2 kg/s, enters the heat exchanger at 400°C and must leave at 215°C . To limit the pressure drop within the tubes, the tube gas velocity should not exceed 25 m/s. If saturated water at 11.7 bar is supplied to the shell side of the exchanger, determine the required number of tubes and thier lengh.Assume that the properties of the exhaust gas can be approximated as those of atmospheric air and that the water side thermal resistance is negligible. However, account for fouling on the gas side of the tubes and use a fouling resistance of 0.0015 m^2. K/W (20 marks)

OR

4. A boiler plant incorporates an economizer and an air preheater and generates steam at 40 bar, 300°C with fuel of calorific value 33 MJ/kg burned at a rate of 0.111 kg/s. In the economizer, the feed water is heated from 40°C to 125°C by recovering the heat from flue gases. The flue gases inlet and outlet temperatures are 395°C to 225°C. The flue gases then enters the air preheater in which air is heated and its temperature rises by 75°C. An FD fan delivers air at 1.02 bar and 16°C producing a pressure head of 180 mm of water. The power input to the fan is 5 kW and it has mechanical efficiency of 76%. Estimate

   i) the temperature of flue gases leaving the plant (10 marks)

   ii) the efficiency of the boiler plant (10 marks)

   Neglecting heat losses and take specific heat is 1.01 kJ/kg.K for the flue gases.

5. Exhaust gas from a furnace is used to preheat the combustion air supplied to the furnace burner. The gas which has a flow rate of 15 kg/s and an inlet temperature of 1100 K, passes through a bundle of tubes while the air which has a flow rate of 10 kg/s and an inlet temperature of 300 K is in cross flow over the tubes. The tubes are unfinned and the overall heat transfer coefficient is 100 W/m^2 K. Determine the total tube surface area required to achieve an air outlet temperature of 850 K. The specific heat of gas and air is 1.075 KJ/Kg K (20 Marks)

OR

6. Describe briefly about the recuperator and regenerator for waste heat recovery application? (10 marks)

   Describe the working principle of a plate type heat exchanger with a sketch? (10 marks)

7. Feed water from the high pressure heater enters the inlet header of the economizer at the rate of 500 kg/s and at 150 bar, 160°C. It is heated by flue gases till it becomes saturated liquid at that pressure and leaves the outlet header to flow into the drum. Flue gases flow over the economizer coils at the rate of 1200 kg/s and leave at 400°C. The flue gas velocity is 10 m/s and the optimum water velocity leaving the coil is 1.5 m/s. The tubes are 60 mm OD and 50 mm ID. The overall heat transfer coefficient is 80 W/m² K.Take specific heat of flue gases as 1.1 kJ/kg K. If the vertical pitch of the coil is 90 mm and the clearance on the two sides of the duct of width 4.5 m is 6 mm. Determine

i) the number of coils needed in the economizer (7 marks)

ii) the length of one coil (7 marks)

iii) the vertical height of the economizer coils. (6 marks)

OR

8. Describe briefly about the cost analysis of a combined cycle plant? (10 marks)

Describe briefly about the cost analysis of a regenerator for waste heat recovery application? (10 marks)

9. A recuperator used as an energy conservation measure employs a cross flow heat exchanger with both fluids unmixed. The exchanger is designed to remove 200 KW from 1300 kg/min of atmospheric air entering at 30°C. This energy is used to preheat the same quantity of air which enters from outdoor conditions at 5°C before being used for a building heating application. The design value of U for this flow condition is 40 W/m² °C. Find
i) the design value for the area of the heat exchanger (10 marks)

ii) the % reduction in heat transfer rate if the flow rate is reduced by 60 % while keeping the inlet temperature and value of U constant (10 marks)

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End Semester Examinations - Nov-Dec 2015 Exams

14ME3035 Solar Thermal Energy Conversion

Set A

Time : 3 hrs
Total Marks: 100

1. a) Illustrate the radiative properties of non-absorbing materials with necessary equations.(10)

   b) Calculate the transmittance, reflectance and absorptance of a single glass cover 2.3 mm thick at an angle of 60 deg. The extinction coefficient of the glass is 32 m^{-1} and the refractive index of the glass is 1.526.(10)

OR

2. a) Find the solar altitude and azimuth angles at solar noon in Coimbatore on August 8. Also find the sun rise and sunset times on that day. The latitude nd longitude values of Coimbatore is 11.02° N, 76.97° E. (10)

   b) Compare the different selective surface coating methods with respect to the type of material used and the constructional details. (10)

3. a) Develop the relationship between the Reflectance, Absorptance and Emittance of opaque materials using Kirchoff's Law of thermal radiation.(5)

   b) Identify the need for selective surface coating on solar collectors and discuss how efficiency gets increased with help of coating? (10)

   c) Illustrate the specular and diffused reflection on ideal surfaces with necessary diagrams.(5)

OR

4. a) Analyze radiation characteristics of non-absorbing materials using Snell's Law of Refraction. (10)

   b) Define the following terms with neat diagram.(10)

   i. Solar Altitude angle
   ii. Solar Azimuth angle
   iii. Solar Zenith angle
   iv. Solar Hour angle

5. a) Suggest the instruments used to measure Solar radiation and explain any one of them in detail. (10)

   b) Perform thermal analysis on Flat plate collectors and also derive the expression for collector efficiency. (10)

OR

6. a) Explain how Parabolic trough solar collector is used to collect Solar radiation.(10)

   b) Identify the need for tracking the sun in parabolic trough solar collector and explain the different methods.(10)

7. a) With necessary diagrams, describe how thermal energy can be stored in water storage and packed bed storage system. (10)

   b) If you are asked to design a thermal energy storage system, what are the factors that you would look for? Explain them in detail. (10)

OR

8. a) How will you overcome the freezing condition or power failure in direct circulation method? Explain in detail. (10)

   b) Elucidate the direct circulation method of Solar water heating with a neat block diagram. (10)

9. a) With help of neat diagram, elucidate the possibilities of combining the solar system with the existing heat

supply in industrial process heat. (15)

b) Discuss the research status in solar desalination system. (5)

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End Semester Examinations - Nov-Dec 2015 Exams

15ME3006 Design of Fluid Power Systems

Set B

Time : 3 hrs
Total Marks: 100

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1. a. Draw a basic block of a circuit showing the reservoir, accessories, pressure relief valve and the pump and tank lines. 8 Marks

   b. Illustrate the use of a sequence valve with a simple hydraulic circuit. 4 Marks

   c. A puimp has a displacement volume of 100 cm^3 . It delivers 0.0015 m^3/s at 1000 rpm and 70 bars. If the prime mover input torque is 120 N-m.

   a. What is the overall efficiency of the pump. b. What is the theoritical torque required to operate the pump. 8 Marks

OR

2. a. State the working principle of a radial piston pump with a neat sketch 10 Marks

   b. A Gear pump has a 75 mm outside dianmeter, a 50 mm inside diameter and a 25 mm width. If the volumetric efficiency is 90% at rated pressure, what is the corresponding actual flow rate, if the pump speed is 1000 rpm. 10 Marks

3. a. Make a hydraulic circuit showing the connections to a hydraulic motor through a three- position, four-way, double solenoid, spring-centered, A and B connected to the tank port in neutral position. 8 Marks

   b. A hydraulic motor has a displacemen of 10 in^3 and operates with pressure of 1000psi and a speed of 2000 rpm. If the actual flow rate consumed by the motor is 95 gpm and the actual torque delivered by the motor is 1500in.lb, find three efficiencies of the motor and the actual horse power delivered by the motor. 12 Marks

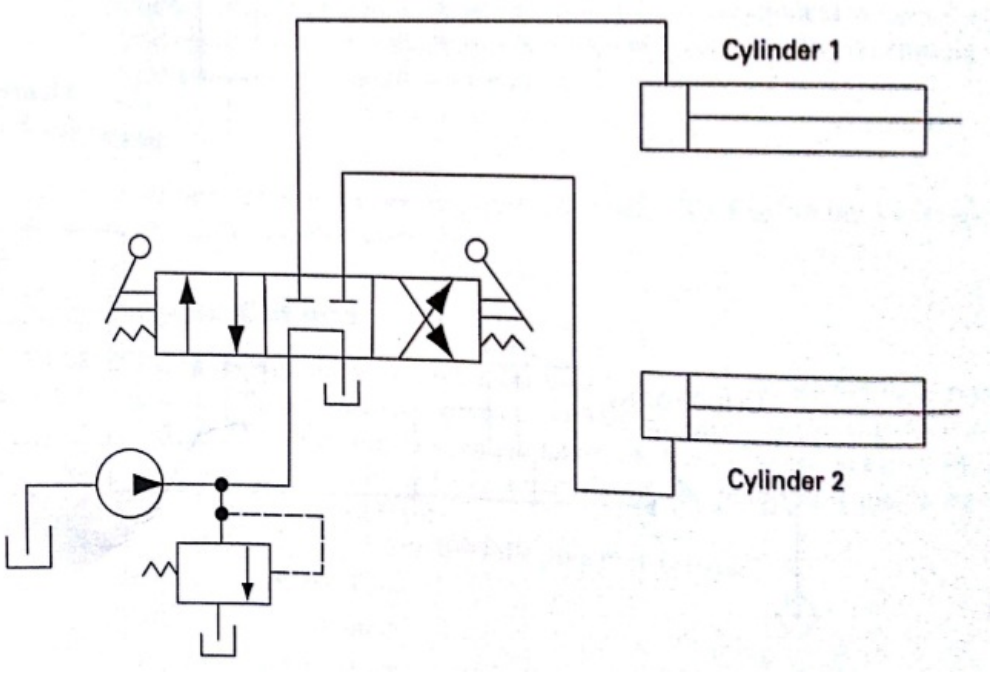
OR

4. a. For the circuit of Figure below which of the following is true? Explain your answer and list the components.

   a. As cylinder 1 extends, cylinder 2 extends.

   b. As cylinder 1 extends, cylinder 2 retracts.

   c. As cylinder 1 extends, cylinder 2 does not move 5 Marks



b. Design an electro pneumatic circuit for a double acting cylinder with capacitive proximity switches incorporated in it, which has to run continuously until a separate push button is pressed. Use the double solenoid pilot operated DCV with manual over ride. 15 Marks

5. a. Discuss the I/O interfacing of the PLC 6 Marks

b. List the merits of PLC 4 Marks

c. Draw and explain the block diagram of PLC 10 Marks

OR

6. a. Draw the ladder logic diagrams for four basic logic gates 8 Marks

b. Design and develop PLC controlled pneumatic circuit for the double acting cylinder to operate continuously until a stop switch is pressed. Use 5/3 double solenoid operated DCV. 12 Marks

7. a. Design and develop an electro pneumatic circuit for **A+B+C+A-B-C-** using Cascade method. 20 Marks

OR

8. a. Design and develop an electro pneumatic circuit for Process Industry Application 10 Marks

b. Design an industrial hydro pneumatic circuit for a hydraulic system operates at elevated pressure (2000psi) to perform the direct labor on the machine and a pneumatic system actuates the control function with a pressure less than 100 psi. 10 Marks

9. a. Draw various ANSI piping design symbols 6 Marks

b. List various types of bulk fluids with their properties. 4 Marks

c. Draw a tentative plan layout for an Industry in which various fluids flow through pipes from one end to other. Fluid transfer from the Tank no. 1 to the other two tanks, Tank-2 and Tank-3. Use some of the pipe supporting arrangements. 10 Marks

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End Semester Examinations - Nov-Dec 2015 Exams

15ME3007 Advanced Tool Design

Set A

Time : 3 hrs
Total Marks: 100

1. Explain the design steps involved and the factors to be considered while designing a single point cutting tool:

OR

2. What are the important characteristics of material that play a major role in selection of tool material? Also explain how the tool characteristics are influenced by different elements in it?

3. (a)What are the factors affect the selection of material for gages? Explain: (15)

   (b) Describe the seven basic elements of workpiece geometry that gages are designed to check? (5)

OR

4. What are the essential requirements for a clamping device. Explain the different types of clamps with neat sketches.

5. (a) Write briefly on 3-2-1 principle of location principle of pin location. (12)

   (b) What are the common defects in jig design? (8)

OR

6. (a) Describe the construction of milling fixture. (10)

   (b) What is modular fixturing? What are the three most common modular fixturing systems? (10)

7. (a) Describe the construction and working of a progressive die. (15)

   (b) Distinguish between a compound die and a combination die: (5)

OR

8. (a) Explain clearly how clearance is essential in shearing operation with the principle of shear action. (5)

   (b) Describe in brief the common shearing operations performed on presses (15)

9. **Compulsory**

   Explain the recent trends in tool design. Also explain the fixture design for CNC machine tools.

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