



- Notes :
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 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.
 11. Use of non programmable calculator is permitted.
 12. Use of tables are permitted.

1. a) What is productivity. State the various factors, tools & techniques to improve productivity. **6**
- b) The data for output produced and input used by a company for a specified period is given in table 1. Assuming deflector for all output and all inputs as 1.2, find the partial and total productivity indices **7**
Table 1.

Particular Output	Input	Labour	Material	Energy	Other
Year 2012	Rs. 1,00,000	Rs. 30,000	Rs. 20,000	Rs. 7,000	Rs. 5,000
Year 2013	Rs. 1,20,000	Rs. 35,000	Rs. 22,000	Rs. 10,000	Rs. 6,000

OR

2. a) Define method study. What are its objectives? Differentiate between work measurement and method study. **6**
- b) What are therbligs? Give any five therbligs with symbols. How are they useful for micromotion study? **7**
3. a) What are the ergonomic considerations in man machine system? What are the objectives of ergonomics? **6**
- b) State various techniques of work measurement. Also List down the factors affecting performance rating. **7**

OR

4. a) What are the different types of allowances. How is standard time computed on the basis of allowances? 6
- b) The following data refers to the study conducted for an operation. Table 2 shows actual time for elements in minutes 7

Table. 2.

Elements	Cycle				
	1	2	3	4	5
1	2.5	2.1	2.2	5.4	2.5
2	6.2	6.0	6.1	5.9	5.9
3	2.3	2.0	2.1	2.1	2.2
4	2.4	2.1	2.8	3.0	2.3

- i) Element 2 is machine element
- ii) Consider the observations as abnormal and delete the same if they are more than 20% of average time of element.
- iii) Take performance Rating as 120.
- iv) Take following allowances and personal allowances = 30 minutes in shift of 8 hours. fatigue allowance = 15%, contingency allowance 2% estimate the standard time of production per 8 hour shift.
5. a) What is the need of forecasting? How are forecasting methods classified? 7
- b) A company manufacturing washing machines establishes a fact that there is a relationship between sale of washing machines and population of the city. The market research carried out reveals the following information 7

Population (Million)	5	7	15	22	27	36
No. of washing machines demanded	28	40	65	80	96	130

Fit a linear regression equation and estimate the demand for washing machines for a city with a population of 45 million.

OR

6. Discuss in brief **any three**. 14
- i) Work sampling
- ii) Principles of motion economy (Use of Human body)
- iii) Types of Productivity.
- iv) Forecast errors
- v) Work sampling.

7. a) What is Bath tub curve? Explain it with the help of neat sketch. **6**
- b) What are the types of maintenance. Explain them in brief. **7**

OR

8. a) Differentiate between maintainability, Availability & Reliability. What are the objectives of Maintenance. **6**

OR

- b) Determine reliability of communication system having two transmitters in parallel connected to receiver & encoder in series. Reliability of transmitter is 85% and that of Receiver is 99% and for encoder is 94%. Also discuss how is preventive maintenance different from predictive maintenance. **7**
9. a) Define quality control. State the functions, objectives & characteristics of Quality control. **6**
- b) Following are inspection result of magnet for 15 observations. Calculate average fraction defect 3σ (3 sigma) control limits. Construct control chart and state whether process is in control. Number of magnets inspected/observation is 700. **7**

Week No	1	2	3	4	5	6	7	8
No. of defects	48	83	70	85	45	56	48	67

Week No.	9	10	11	12	13	14	15
No. of defects	37	52	47	50	47	57	51

OR

10. a) What are the types of sampling? State the concepts & significance. **6**
- b) A component with specification limit is given as 17.5 ± 0.23 while inspection. The components were taken in subgroups of 4 items After 20 subgroups, the values of \bar{X} & R were found to be $\Sigma \bar{X} = 350$ & $\Sigma R = 8.5$. Assuming the process in control what conclusion would you draw about the ability of process to produce the item within specified limits (Assume $d_2 = 2.059$, $D_3 = 0$; $D_4 = 2.28$) **7**
11. Write short notes on **any three**. **14**
- a) DC Curves
- b) MTTR, MTBF, MTTF
- c) Inspection Types & objectives
- d) Quality Assurance & planning
- e) Quality Audit.

OR

12. Write short notes on **any three**.

14

- a) Vendor Quality Rating
- b) ISO 9000
- c) Philosophy of six Sigma
- d) TQM
- e) Approaches to quality improvement



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 7. Solve Question 11 OR Questions No. 12.
 8. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) What are the different types of thermostat used in automobile? Explain with neat sketch working of wax type thermostat. **6**

b) Explain the construction and working of solex carburetor. **7**

OR

2. a) Explain with neat sketch pressure feed lubrication system. Also give its advantages over other systems. **6**

b) What are the different types of frames used in automobile? Write its functions and briefly discuss any one of them. **7**

3. a) Explain with neat sketch construction and working of diaphragm type single plate clutch. **7**

b) What is Transfer Box? Write its functions. Also discuss its working with neat sketch. **7**

OR

4. a) Enlist the types of Gear boxes used in automobile. Explain the construction and working of sliding mesh Gear box with neat sketches. **8**

b) Classify the Gear selector mechanism. Explain in detailed any one gear selector mechanism. **6**

5. a) Compare Hotchkiss and torque tube drive. **6**

b) Classify Axles. Explain with neat sketch full floating Axle. **7**

OR

6. a) Explain with neat sketch construction and working of engine exhaust brake. **7**

b) Write the construction and working of double leading drum brake. Also gives its advantages over single lead brake. **6**

7. a) What is center point steering? How it is achieved and what are the benefits of centre point steering towards vehicle stability and tyre performance. **8**
- b) Explain with neat sketch construction and working of re-circulating ball type steering gear box. **6**

OR

8. a) Explain in detail with neat sketch "Double wishbone, suspension". Also write its advantages. **7**
- b) Discuss in brief leaf spring suspension. **7**

9. Discuss following **any two**. **13**

- 1) Panel Board instruments in Cars.
- 2) Magneto ignition system.
- 3) Battery (lead acid)

OR

10. Discuss following **any two**. **13**

- 1) Factors affecting tyre life.
- 2) Wheel balancing.
- 3) Tubeless tyre.

11. a) What is active suspension? Explain the working of active suspensing along with skyhook theory. **7**
- b) What are the different requirements of automobile body? Explain. **6**

OR

12. a) Explain the functions and working of electronic brake force distribution system in automobile. **7**
- b) What are the different navigational aids used for guiding/directing the vehicle on road or sea or air. **6**



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 9. Assume suitable data whenever necessary.
 10. Use of steam table, Mollier diagram is permitted.

1. a) What is load curve? give its significance. 4
- b) A generating unit of 10 MW capacity supplies the following loads: 10
- i) Domestic consumers with maximum demand of 6 MW at a load factor of 20%
 - ii) Small industrial load with maximum demand of 3.6 MW at a load factor of 50%
 - iii) Street light load with maximum demand of 400KW at 30% load factor.
- Find overall cost of energy per kWh for each type of consumer using following data.
- Capital cost of the plant = Rs. 10,000 per kW
total running cost = Rs. 36,00,000 per year.
Annual rate of interest and depreciation on
Capital cost = 10%
- OR**
2. a) The yearly duration curve of certain plant can be considered as a straight line from 20 MW to 3 MW. To meet this load, three turbine generator units, two rated at 10 MW and one at 5 MW are installed 8
- Determine
- i) Installed Capacity
 - ii) Plant factor
 - iii) Maximum demand
 - iv) Load factor
 - v) Utilization factor.
- b) Explain the principle of economic scheduling. 6
3. In a thermal power plant steam expands from 150 bar, 550°C to 0.1 bar. Find out extraction point for four regenerative heaters. What would be the amount of bleeding steam in each case. 13
- OR**
4. a) Explain with neat sketch modern pulverized coal fired thermal power plant. 7
- b) Write a short note on combined cycle power plant. 6

5. a) Explain pulverized fuel firing and list its advantages and disadvantages. **6**
 b) Discuss fluidized bed combustion. What are the advantages and limitation of FBC? **7**

OR

6. a) What is the principal of an electrostatic precipitator? With the help of neat diagram, Explain electrostatic precipitator. **7**
 b) With the help of neat diagram, explain the working of two types of Air preheater. **6**
7. a) A hydro-electric installation has a catchment area 64 sq.km and the run-off is 70%. The average rainfall per year is 1300 mm and the head is 450m. Find the available power if the rainfall is 80% **8**
 b) Discuss factors affecting the run off. **6**

OR

8. a) The run off data of a river at a particular site is tabulated as below. **10**

Month	Mean discharge (Millions m ³)	Month	Mean discharge (Million's m ³)
Jan	30	July	80
Feb	25	Aug	100
Mar	0	Sept	110
April	0	Oct	65
May	10	Nov	45
June	90	Dec	30

- i) Draw the hydrograph and flow duration curve.
 ii) Find the power developed if the head available is 90 m and overall efficiency of generations 85%
- b) Explain the function of surge tank in hydraulic power plant. **4**
9. a) Write a short note on **6**
 i) Binding energy ii) Fuel Burn up.
 b) Draw the neat sketch of Pressurize Water Reactor (PWR) and explain the role of pressurizer in PWR. **7**

OR

10. Each fission of U-235 yields 190 MeV of useful energy. Assuming that 85% of neutrons absorbed by U-235 cause fission, the rest being absorbed by non fission capture to produce an isotope U-236, Estimate the fuel consumption of U - 235 per day to produce 3000 MW of thermal power. **13**
11. a) Explain with neat sketch closed and open cycle gas turbine power plant along with its advantages and disadvantages. **7**
 b) Draw and explain typical diesel engine power plant. **6**

OR

12. Write a short note on **13**
 i) MHD power generation ii) Solar thermal power generation
 iii) Wind power generation.



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 11. Use of design data book is permissible.

1. a) Explain Role of CAD for Mechanical engineering nowadays in Industry. **4**
- b) Write Bresenham's Mid Point Circle generation algorithm and rasterize a Circle with center at (20,10) and radius 5 units. **9**

OR

2. a) Discuss frame buffer in brief. **4**
- b) Rasterize a line to be drawn from (10,20) to (18,30) using DDA algorithm. Plot the Points on graph paper. **9**
3. a) Why transformation matrix is of order 3x3 in 2-D transformation and 4x4 in 3-D transformation **4**
- b) A triangle is defined by vertices $P_1(0,0)$, $P_2(2,0)$, $P_3(3,2)$ is enlarged thrice in x and y - direction. The vertex P_3 of the enlarged triangle is rotated 30° Counter Clockwise. Find the resultant Points of the triangle and show the transform. **10**

OR

4. a) What is Windowing and clipping? **4**
- b) Find the final position of rectangle define by the coordinates A (1,1), B(4,1), C (4,3) and D (1,3) when it is reflected about line $y = 2x+10$. **10**
5. a) Explain the concept of following modeling techniques with sketch in brief. **5**
 - i) Solid modeling
 - ii) Surface modeling.
- b) Construct the barrier curve of order 3 and with 4 Polygon Vertices $P_0(1,1)$, $P_1(2,3)$, $P_2(4,3)$ & $P_3(6,4)$. **8**
Calculate the coordinates of point on the curve corresponding to the Parameter: $t = 0, 0.25, 0.5, 0.75$.

OR

6. a) What is Assembly modeling? Explain the various mating condition used in generation of assembly modeling. **7**
- b) Explain the following: **6**
- i) Feature based modeling.
 - ii) Parametric based modeling.
7. a) Explain the steps carried out in FEM. **4**
- b) A stepped shaft as shown in figure (1) is fully restrained against rotation about its axis. Twisting moment of 15 kN-m and 20 kN-m are applied at a point of Changing section. Calculate **10**
- i) Angular displacement
 - ii) Stresses
 - iii) Support reactions, Assume $G = \frac{60 \text{ GN}}{\text{m}^2}$, $J_1 = 2 \times 10^7 \text{ mm}^4$, $J_2 = 3 \times 10^7 \text{ mm}^4$ and $J_3 = 2 \times 10^7 \text{ mm}^4$

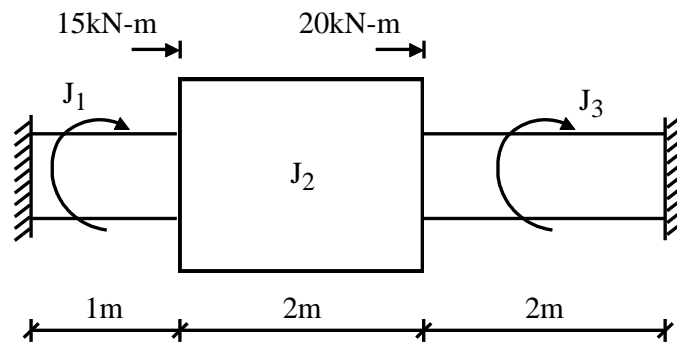


Fig. 1

OR

8. a) Explain principle of minimum potential energy with suitable derivation. **4**
- b) Figure (2) shows a uniform thickness plate i.e $t = 10 \text{ mm}$ fixed at both ends with tapering width. Find i) Nodal displacement and stresses in each section **10**
- Take $E = 200 \text{ Gpa}$.

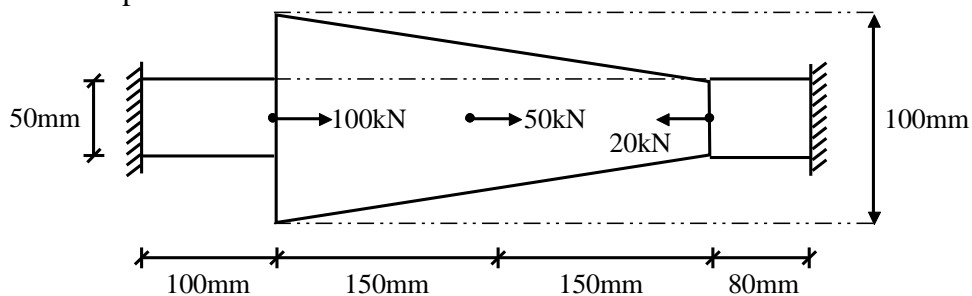


Fig. 2

Energy Conversion - II

P. Pages : 4

NRT/KS/19/3559/3605

Time : Three Hours



Max. Marks : 80

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 10. Use of non programmable calculator is permitted.
 11. Use of steam table, refrigeration table & chart, psychrometric chart are permitted.

1. a) Prove that the volumetric efficiency of a single state compressor is given by **5**
- $$\eta_{vol} = 1 + k - k \left(\frac{p_2}{p_1} \right)^{1/n}, \text{ where } k = \frac{V_c}{V_s},$$
- $p_1 \rightarrow$ suction pressure and $p_2 =$ Delivery pressure and $n =$ Index of expansion.
- b) State the conditions which lower the volumetric efficiency. **2**
- c) A single stage, single acting air compressor running at 1000 rpm delivers air at 25 bar. For this purpose the induction and free air conditions can be taken as 1.013 bar and 15°C, and the free air delivery as 0.25 m³/min. the clearance volume is 3% of the swept volume and stroke/bore ratio is 1.2:1. Take index of compression and expansion as 1.3. Determine : **6**
- i) The indicated power and ii) the bore and stroke of this machine.

OR

2. a) Explain the multistage compression and state its advantages. **3**
- b) A single - acting two stage compressor with complete intercooling delivers 10 kg/min of air at 16 bar. The suction occurs at 1 bar and 15°C. the expansion and compression processes are reversible polytropic with polytropic index $n = 1.25$. Calculate : **10**
- i) The power required to drive the compressor.
- ii) Heat transferred in intercooler.
- iii) If the clearance ratio for LP and HP cylinder are 0.04 and 0.06 respectively, Calculate the swept volume and clearance for each cylinder take speed of the compressor is 400 rpm.
3. a) Explain with the help of neat sketch and P-V diagram, the construction and working of wave blower. **5**

- b) A centrifugal compressor delivers 16.5 kg/s of air with a total head pressure ratio of 4:1. The speed of compressor is 15000 rpm. Inlet total head temperature is 20°C, slip factor 0.9, power input factor 1.04 and isentropic efficiency 80%, calculate : 8
- i) Overall diameter of the impeller
 - ii) Power input to the compressor.

OR

4. a) Explain the following terms related to rotary air compressor : 6
- i) Surging and Choking
 - ii) Degree of reaction
 - iii) Pre-Whirl
- b) An axial flow air compressor of 50% reaction design has blades with inlet and outlet angles of 45° and 10° respectively. The compressor is to produce a pressure ratio of 6:1 with an overall isentropic efficiency of 85% when the air inlet temperature is 33°C. The blade speed and axial velocity are constant throughout the compressor. Assume a value of 200 m/s for the blade speed, find the number of stages required when work factor is 0.89 for all stages. 7
5. a) Describe with a suitable sketch the two stroke cycle spark ignition engine. 5
- b) Describe a simple carburetor with a neat sketch and also state its limitation. 5
- c) Discuss the difference between ideal and actual valve timing diagram of a 2S diesel engine. 4

OR

6. a) Explain the phenomena of knocking in S.I. engine. What are the different factors which influence the knocking ? Describe the method to suppress it. 5
- b) Explain the stages of combustion in C.I. engines with the help of P-θ diagram. 5
- c) Explain the components of fuel injection system system in C.I. engine. 4
7. a) Explain the method of determination of indicated power of a multi-cylinder engine. 4
- b) A 4-cylinder petrol engine has an output of 5 kw at 2000 rpm. A Morse test is carried out and the brake torque readings are 177, 170, 168 and 174 Nm respectively. For the normal running at this speed the specific fuel consumption is 0.364 kg/kwh. The calorific value of fuel is 44200 kJ/kg. Determine : 9
- i) Mechanical efficiency
 - ii) Brake thermal efficiency of the engine.

OR

8. During the trial of a single cylinder, 4-stroke diesel engine the following observations were recorded : Bore = 350 mm, Stroke = 450 mm, rpm = 400, area of indicator diagram = 472 mm², length of indicator diagram = 62 mm, spring constant = 0.59 bar/mm, load on hydraulic dynamometer = 970 N, dynamometer constant = 7500, fuel used= 10.78 kg/n, calorific value of fuel = 50000 kJ/kg, cooling water circulated = 24 litres/min, 13

rise in temperature of cooling water = 24°C. The mass analysis of fuel is : Carbon = 84%, hydrogen = 15%, incombustible = 1%. The volume analysis of exhaust gases is : Carbon dioxide = 8%, Oxygen = 11%, nitrogen = 81%.
 Temperature of exhaust gases = 380°C, Specific heat of exhaust gases = 1.05 kJ/kg k, ambient temperature = 20°C, partial pressure of steam in exhaust gases = 0.03 bar, specific heat of superheated steam = 2.1 kJ/kg k. Draw up the heat balance sheet on percentage and minute basis.

9. a) Discuss the desired characteristics of refrigerant used in vapour compression system. Also give nomenclatures of refrigerant based on methane and ethane. **6**
- b) A vapour compression refrigeration uses R-12 as refrigerant and the liquid evaporates in the evaporator at -15°C. The refrigerant leaves the compressor at dry saturated vapour at -15°C. Find **8**
- i) COP if there is no undercooling
- ii) COP if the liquid is subcooled by 5°C &
- iii) Percentage increase in COP due to subcooling $C_{p \text{ liquid}} = 0.747 \text{ kJ/kg k}$

OR

10. a) Sketch and explain in brief the working of simple vapour absorption system. Also give its advantage over VCR system. **5**
- b) A food storage locker require a refrigeration capacity of 50 kw. It works between condenser temperature of 35°C and an evaporator temperature of -10°C. The refrigerant is ammonia. It is subcooled by 5°C before entering the expansion valve and dry saturated vapour leaves an evaporator. Assume single cylinder, single acting compressor operating at 1000 rpm with stroke equal to 1.2 times the bore. Determine : **9**
- i) The power required to drive the compressor
- ii) The cylinder dimension and iii) COP of system
- $C_{p \text{ liquid}} = 4.556 \text{ kJ/kg k}$, $C_{p \text{ vapour}} = 2.903 \text{ kJ/kg k}$
11. a) Explain the following terms related with moist air **4**
- i) Specific humidity ii) Dew point temperature
- iii) Degree of saturation iv) Wet bulb temperature
- b) The reading from a sling psychrometer are as follows : **9**
- Dry bulb temperature = 30°C, wet bulb temperature = 20°C ;
 Barometric reading = 740 mm of Hg. Using steam tables, determine :
- i) Dew point temperature ii) Relative humidity
- iii) Specific humidity iv) Degree of saturation
- v) Vapour density and vi) Enthalpy of mixture per kg of dry air.

OR

12. a) Explain the following psychrometric processes using air washer 4
- i) Cooling and dehumidification
 - ii) Heating and humidification.
- b) The air at 30°C dry bulb temperature and 60° relative humidity is passed through a cooling coil at the rate of 250 m³/min. The air leaves the cooling coil at 14°C dry bulb temperature. If by-pass factor is 0.1. Determine : 9
- i) The surface temperature of the cooling coil (ADP)
 - ii) Relative humidity of the air leaving the cooling coil.
 - iii) Sensible heat factor, and
 - iv) Cooling coil capacity in kw.
- Use psychrometric chart.

Design of Mechanical Drives

P. Pages : 2

NRT/KS/19/3560/3606

Time : Three Hours



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 9. Use of Design data book is permitted.

1. a) Design a bushed pin type of flexible coupling for connecting motor shaft to a centrifugal pump shaft for the following service conditions. **10**
 Electric motor - 30 kW at 960 rpm Diameter of pump shaft - 60 mm
- b) The details of the hydrodynamic bearing for a diesel engine crankshaft are given below. **10**
 Max. Load on bearing = 16 kN
 Speed = 2000 rpm
 Diam. of crank shaft = 75 mm
 Clearance ratio (C/R) = 0.075
 Viscosity of oil = 25 Cp
 Min film thickness $h_{min} = 0.03$ mm
 Inlet oil temperature $t_a = 35^\circ\text{C}$
 Determine
- | | |
|----------------------------|------------------------------|
| i) The bearing pressure | ii) Length of bearing |
| iii) Frictional power loss | iv) Quantity of oil required |
| v) Out oil temp. | |

OR

2. a) A multi cylinder engine is to run at a constant speed of 700 rpm in T- θ diagram. The areas above and below the mean torque line in mm^2 are as follows. **10**
 + 170 ; - 180; +175; - 205; + 195; - 155.
 The scales for the diagram are for torque 1 mm = 225 N.m and for crank angle 1 mm = 4 degree. The speed is to kept $\pm 2.5\%$ of the mean speed of the engine. Design the suitable C.I. flywheel for the engine.
- b) A 6309 single row deep groove ball bearing with the inner ring rotating has a 20 second work cycle as given below. **10**

Item	For 12 sec	For 8 sec.
Radial load	3600 N	2700 N
Axial load	1800 N	800 N
Speed	900 rpm	1200 rpm
Type of load	Light shock	Steady

Find expected average life of the bearing in hours of operation.

3. a) A belt is required to transmit 20 kW from a pulley 1.2 m diameter running at 250 rpm to another pulley which runs at 450 rpm. The distance between the centers of the two pulleys is 2.7 m. The center line of the drive makes an angle of 50° with the horizontal. Specify a suitable flat leather belt for the drive. **10**

b) A roller chain drive is to be used in a power plant to transmit 15 kW from an electric motor to reciprocating pump. The pump is to operate continuously 24 hours a day. The speed of the motor is 720 rpm and that of the pump is 250 rpm. Design the drive and give the specifications for the sprockets and the chain. **10**

OR

4. a) Select a suitable wire rope for a mine hoist carrying a load of 25 kN to be lifted from a depth of 120 meters. A rope speed of 15 m/sec must be attained in 10 seconds. **10**

b) A centrifugal water pump running at 1200 rpm is driven by a 50 kW diesel engine running at 400 rpm. The engine flywheel is to be used as the driving pulley. Design a V-belt drive if the center distance should not be greater than 1.2 meters. **10**

5. Design a spur gear drive to connect electric motor with reciprocating pump. Speed of the motor is 1500 rpm and speed reduction is 5:1. Motor power is 30 kW. Also design gear blank for larger gear. **20**

OR

6. Design a pair of straight teeth cast iron bevel gears to transmit 60 kW from a shaft running at 235 rpm to another running at 75 rpm. Check for continuous operation. Assume steady load. **20**

7. A worm gear drive is used for lifting the elevator cage at a rate of 100 m/min. The elevator drum diameter is 600 mm and the load to be lifted is 20 kN. The worm gear is keyed to the drum shaft. The elevator is driven by an electric motor running at 960 rpm. Determine
i) The worm and worm gear proportions.
ii) The temperature rise of the oil and
iii) The required power of the motor if the efficiency of the hoist is 94 percent. **20**

OR

8. a) Design a cast iron piston for a single acting four stroke engine for the following specifications. **16**

Cylinder bore = 100 mm; stroke = 120 mm

Maximum gas pressure = 5 MPa

Break mean effective pressure = 0.65 MPa fuel consumption = 0.25 kg/kw/hr

Speed = 2000 rpm

b) Explain the advantages of wet Liners and dry Liners. **4**

B.E. (Mechanical Engineering) Seventh Semester (CBS)
Industrial Engineering

P. Pages : 3

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AHK/KW/19/2315

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 10. Diagrams and chemical equations should be given whenever necessary.
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 12. Use of non programmable calculator is permitted.
 13. Quality control charts to be used, \bar{X} & R chart tables permitted.

1. a) Enlist the factors influencing productivity. Explain how each factor will affect productivity. **8**
- b) Define method study. What are its objectives? **6**

OR

2. a) Construct a flow process chart for "Making the casting ready for machining". **7**
- b) What are therbligs? Give any five therbligs with symbols. **7**
3. a) Define work measurement. State its objectives. **6**
- b) A particular activity on the shop floor consists of three elements. Calculate the standard time for the activity. **7**

Elements	I	II	III
Observed time in minutes	0.75	1.80	2.50
Rating factor	110%	125%	120%
<u>Allowances</u>			
i) Relaxation	10%	12%	10%
ii) Personal	5%	2%	2%
iii) Delay	5%	2%	3%

OR

4. a) Define ergonomics. Describe principles of motion economy for workplace design. **7**
- b) Describe various types of predetermined motion time systems (PMTS). **6**
5. a) Describe Qualitative methods of forecasting. **7**

- b) The sales for the product is given below. Estimate the demand for the year 1985. Find the trend values for each of the five years also. 6

Year	1980	1981	1982	1983	1984
Sales (Rs.) (000)	50	65	75	52	72

OR

6. a) Estimate the sales forecast for the year 1992. Using exponential smoothing take $\alpha = 0.3$. Take the sales forecast of Year 1984 at Rs. 16000/- 7

Year	1984	1985	1986	1987	1988	1989	1990	1991
Sales (Rs. x 100)	180	168	160	170	188	205	190	210

- b) A company manufacturing tractors finds that there exists a relationship between sales of tractors and index of the agricultural income. The data is given below. 6

Demand ('000) (Y)	100	112	130	150	280
Demand index (X)	125	140	180	190	220

- i) Fit a regression line
ii) Estimates sales of tractors for demand index 240

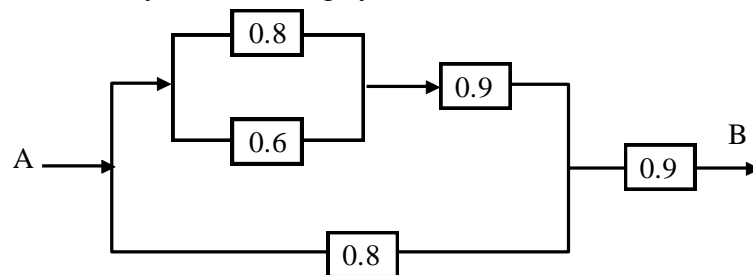
7. a) Define maintenance. Explain various types of maintenance. 7

- b) Describe various types of failures with the help of bath tub curve. 6

OR

8. a) A system is composed of three components, each components has an exponential time of failure distribution with constant failure rate of 0.5 per 4000 Hrs. Compute component reliability & system reliability of 2000 Hrs. of operation if components are connected in series. 7

- b) Compute system reliability for following system between A and B. 6



9. a) Describe objectives of Quality Control Process. 6

- b) A subgroup of 5 items are taken from a manufacturing process at a regular interval. A certain quality characteristics is measured and \bar{X} and R values computed. After 25 subgroups it is found that $\Sigma \bar{X} = 357.50$ and $\Sigma R = 8.80$. If the specification limits are 14.40 ± 0.40 and if the process is statistical control what conclusion can you draw about the ability of the process to produce items within specification? 8

OR

10. a) Explain operating characteristics curve (OC) with a neat sketch. 7

b) The following table shows the number of defects observed in 25 similar castings. 7

Casting no.	1	2	3	4	5	6	7	8	9	10	11	12	13
No. of defects	7	14	14	18	8	14	8	11	20	12	22	15	8
Casting no.	14	15	16	17	18	19	20	21	22	23	24	25	
No. of defects	24	14	9	9	11	10	8	9	11	7	26	8	

i) Find \bar{c}

ii) Compute trial control limits.

iii) What value of \bar{c} can you suggest for subsequent period eliminating observation lying beyond control limits?

11. a) Explain tools of statistical Quality Control. 7

b) Define Quality audit. What are types of quality audit? 6

OR

12. a) Describe elements of Total Quality Management (TQM). 6

b) Explain ISO 9000 series standards. 7



- Notes :
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 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Discuss importance of Robot in industry. Draw a neat schematic line sketch of robot wrist showing various motions on it. **7**

b) Explain with the help of sketches various configuration of robots. **7**

OR

2. a) Explain work envelope, work volume, Repeatability & degree of freedom in detail. **7**

b) Explain in brief joint notation schemes in context of robots. **7**

3. a) What is an End-effectors? Classify end effectors & explain any one with neat sketch. **7**

b) Explain working of active and passive grippers. **6**

OR

4. a) Discuss in detail hooking and lifting grippers. **7**

b) Explain drive systems for gripper in robots. **6**

5. a) Discuss in brief forward & Reverse kinematics. **7**

b) What is the function of a robot controller? Describe servo and non-servo systems. **6**

OR

6. a) Describe Point to Point and Continuous Path Control of robot. **7**

b) Explain in detail methods of robot programming. **6**

7. a) Explain with neat sketch the working principle and application of proximity sensors. **7**

b) Discuss safety measures in robots in context to input output interface. **6**

OR

8. a) Explain with neat sketch electro-optical imaging sensor and give its application. 7
b) Explain in brief machine intelligence. 6
9. a) Explain in brief various types of robot cell layout. 7
b) Discuss interlocking in work cell. 6

OR

10. a) Explain in brief other considerations in work cell design of robot. 7
b) Describe in brief cycle time analysis. 6
11. a) Enlist and Discuss general consideration in robot material handling. 7
b) Explain stamping press operation using robot. 7

OR

12. a) Explain use of robot in die casting and plastic moulding in brief. 7
b) Explain the loading and unloading operation using robot. 7



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 9. Illustrate your answers whenever necessary with the help of neat sketches.
 10. Use of non programmable calculator is permitted.
 11. Use of design Data Book is permitted.

1. a) Explain geometry of single point cutting tool with neat sketch. 7
- b) Derive relationship between ϕ , β & α using Merchant's theory. 7

OR

2. a) Describe the factors on which tool life and tool wear depends. 5
- b) The following data relates to : on orthogonal turning process 9
Chip thickness = 0.62 mm
Feed = 0.2 mm/rev
Rake Angle = 15°
Calculate :-
i) Cutting ratio ii) Shear angle
iii) Shear strain involved in deformation process.

3. a) Enlist different types of milling cutters. Explain different factors to be considered while designing milling cutter. 7
- b) What is Broach? Describe its geometry with various design elements. 6

OR

4. a) Explain with neat sketch the geometry of Twist Drill. 5
- b) A 300 mm diameter bar is turned at 45 rev/min with depth of cut of 2 mm and feed of 0.3 mm/revolution. The forces at the cutting tool points are 8
i) Cutting force = 1850N
ii) Feed force = 450N.
Calculate:-
i) Power consumption
ii) Specific cutting energy
iii) Energy consumed if amount of metal removed during turning operation is $2.5 \times 10^6 \text{mm}^3$.

5. a) What do you mean by press working? Describe with neat sketches different press working operations. **7**
- b) Enlist various types of dies? Explain any one with neat sketch. **6**

OR

6. a) What are different types of sheet metal working dies. Explain progressive dies with neat sketch. **7**
- b) Explain with neat sketch "Punch controls hole size & die controls blank size". **6**
7. a) Sketch and explain V-bending and U-bending dies. **7**
- b) What do you mean by spring back effect in case of bending? How it is prevented. **6**

OR

8. The symmetrical cup work piece shown in figure 8 is to be made from cold rolled steel ($S_{yt} = 400 \text{ N/mm}^2$) & sheet thickness of 0.8mm. Design completely the drawing die for this part. **13**

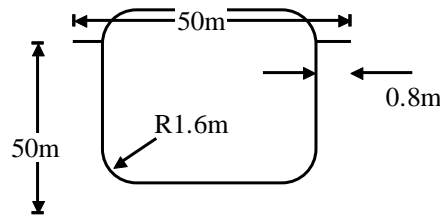


Fig. 8

9. a) Classify various forging dies? Describe various design factors in forging. **7**
- b) Differentiate between single Impression & multi impression dies. **6**

OR

10. State & explain general steps for designing forging dies for 'Drop forging' **13**
11. a) State general principals for designing Jigs and fixture. **6**
- b) Classify types of locators? Describe any one locator in detail. **8**

OR

12. a) Explain with neat sketch the indexing fixture in brief. **7**
- b) Explain 3-2-1 principle of location with neat sketch. **7**

B.E. (Mechanical Engineering) Seventh Semester (CBS)
Elective-I : Automobile Engineering

P. Pages : 2

Time : Three Hours



AHK/KW/19/2318

Max. Marks : 80

- Notes :
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 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Explain chassis layout and its component with neat sketch. Write function of any five components in brief. **7**

b) What is value timing diagram. Explain value timing diagram for four stroke petrol engine. **6**

OR

2. a) What is the necessity of lubrication system in automobile? Explain with neat sketch dry sump lubrication system. **7**

b) What is the necessity of engine cooling system? Explain thermosyphon water cooling system with its advantages. **6**

3. a) State the function of clutch. Explain with neat sketch multi plate clutch. Give its advantages. **7**

b) Explain with neat sketch construction & working of sliding mesh gear box give its merits. **6**

OR

4. a) With the help of neat sketch explain fluid flywheel. Write its advantages. **7**

b) Enlist the type of gear selector mechanism. Explain any one with neat sketch. **6**

5. a) Explain with neat sketch construction & working of constant velocity joint, also state its advantages and limitations. **7**

b) Explain with neat sketch working of Hydraulic braking system with advantages. **7**

OR

6. a) Discuss the necessity of differential in automobile. Explain construction & working with neat sketch. 7
- b) Explain with neat sketch construction & working of vacuum brake system. 7
7. a) Explain briefly Rack and Pinion steering gear with neat sketch. 7
- b) How suspension helps to improve performance of vehicle? Explain in detail leaf-Spring with neat sketch. 7

OR

8. a) Explain the term camber, caster and steering axis inclination with its effect on steering characteristics. 7
- b) Explain with neat sketch Air-Suspension system stating its advantages. 7
9. a) What are the different panel board instruments? Explain any two with neat sketch. 6
- b) State the essential requirements of wheel in case of automobile. Explain briefly various types of automobiles wheels. 7

OR

10. a) Write short on automobile air conditioning system. 6
- b) Explain the Battery ignition system used in an automobile with neat sketch. Also state its salient features. 7
11. a) Explain with neat sketch Anti Lock Braking system. 7
- b) Write down the requirements of Automobile body and discuss the various materials used for automobile bodies. 6

OR

12. a) With the help of neat sketch explain the working of electronic power steering. 6
- b) Write short notes on – 7
- i) Active suspension system.
- ii) Various collision avoidance techniques used in automobile.



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 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.
 11. Use of non programmable calculator is permitted.

1. a) Define the following terms. 6
 - i) Connected load. ii) Load factor.
 - iii) Maximum demand. iv) Demand factor.
- b) A residential load of a locality is given below: 7

Time (Hrs)	Load in (kW)
0 – 5	02
5 – 6	06
6 – 9	20
9 – 18	00
18 – 21	12
21 – 24	18

Draw the load curve and find out the load factor and energy consumed during 24 Hrs.
2. a) State tariff methods for electrical energy. Explain three part tariff. 6
- b) The maximum load on 2500 kW capacity diesel plant is 1600 kW the load factor is 0.048. Taking the following data, determine the cost of generation in Rs/kWh. Installation cost = Rs. 18,000 / kWh, interest on capital = 15%, maintenance cost = 2,00,000 / year. Total labour and other consumables = Rs. 8,50,000 / year. Fuel cost = Rs. 7 / kg, lubrication cost = Rs. 30 / kg, Fuel consumed = 0.25 kg / kWh. 7
3. a) Explain, Rankine cycle using P – V & T – S diagram. 6
- b) State the design considerations of Reheat cycle and differentiate between open and closed feed heaters. 7
4. a) Explain construction and working of Mercury and steam binary cycle. 6
- b) Explain the following in thermal power plant: 7
 - i) Cogeneration ii) ESP
5. Write short notes on **any three**. 14
 - i) Draught and its classification.
 - ii) Gradation and analysis of coal.
 - iii) Types of stokers.
 - iv) Fuel firing methods.
 - v) Circulating fluidized bed combustion.

6. Write short notes on **any three**. 14
- i) Superheater.
 - ii) Air preheater.
 - iii) Economiser.
 - iv) Ash handling systems.
 - v) Coal handling systems.

7. a) How rainfall is measured? Explain construction and working of recording type rainfall measuring device. 6
- b) State and explain factors affecting runoff and its measurement. 7

8. The monthly discharge for 12 months at a particular site is tabulated below. 13

Month	Discharge in millions of m^3 / month
April	500
May	200
June	1500
July	2500
August	3000
September	2400
October	2000
November	1500
December	1500
January	1000
February	800
March	600

Draw :

- i) Hydrograph for given discharge and find average monthly flow.
- ii) Find the power available at mean flow of water if the available head is 80 m at the site and overall efficiency of generation is 80%.

Take 30 days in a month.

9. a) Explain Nuclear fission and Nuclear fusion. 6
- b) What are the various solid wastes generated in nuclear power plant? How they are disposed off. 7
10. a) State the difference between PWR and BWR. Explain advantages and limitations of BWR over PWR. 6
- b) Explain the construction and working of CANDU reactor. State the advantages & disadvantages of it over the other reactors. 7
11. a) State and explain various methods used to improve the thermal efficiency of a gas turbine plant. 7
- b) Explain the construction and working of diesel electric power plant with its advantages and disadvantages. 7
12. a) Explain in detail photo electric power plant. 7
- b) Explain MHD power generation system with types. 7



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 12. Use of Design Data Book is permissible.

1. a) Explain computer Aided Design. How the CAD tools support the Design process. **7**
- b) What is Raster Scan display? Explain the simple color frame buffer with a neat sketch. **6**

OR

2. a) Rasterize a line having end coordinates A(2, 5) and B(6, 10) using DDA line generation algorithm and show it on graph paper. **7**
- b) Rasterize a circle with radius 10 units by using Bresenhams circle algorithm. **6**
3. a) A triangle ABC having its vertices A[3, 5] B[8, 6] C[8, 13]. It is to be translated by 3 unit in x – direction and 5 units in y – direction, then it is rotated in anticlockwise direction about fixed point [6, 10] through 90°. Find the final position of triangle. **8**
- b) A triangle formed by A(5, 1); B(6, 3) C(7, 1) is to be reflected about a line $y = 3$. Find transformation matrix & co – ordinates of reflected triangle. **6**

OR

4. a) A sphere having centre (10, 10, 10) and radius 8 units is translated by 3 units in x direction and 5 units in z direction. Then it is rotated by 45° in anticlockwise direction about y axis . Find the new centre point coordinates of the sphere. **8**
- b) Translate the unit cube by 3 units in x, y and z direction. **6**
5. a) Explain bezier curve along with its features. **4**
- b) Draw Bezier curve with following central points. **9**
(1, 1) ; (2, 3) ; (4, 3) and (3, 1). Determine five points on Bezier curve. Take step size of $t = 0.2$.

OR

6. a) Write short notes on **any three**. 13
- i) Assembly modeling.
 - ii) Precedence Diagram.
 - iii) CSG and B – rep techniques.
 - iv) Geometric modeling.

7. a) Explain the basic steps of FEM. 4
- b) For a step shaft as shown in fig. 1. having shear modulus 80 GPa being subjected to torques as shown in fig. 1. 9
- Calculate
- i) Angular Displacement.
 - ii) Shear stress in each section.
 - iii) Support reaction.

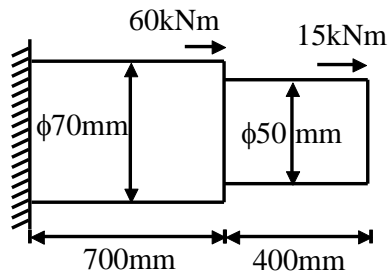


Fig. 1

OR

8. Figure 2 shows a taper bar subjected to a point load of $P_2 = 10\text{kN}$ and $P_3 = 8\text{kN}$ having $E = 2 \times 10^5 \text{ mPa}$. Determine deflection stresses and support reaction. 13

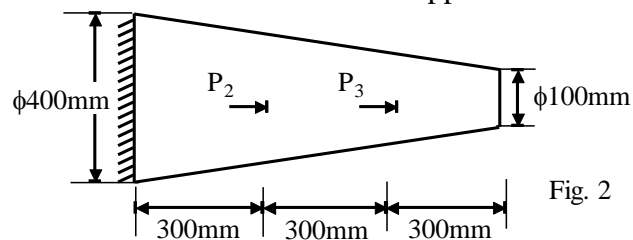


Fig. 2

9. For the Truss shown in figure 3, Determine the nodal displacement, stresses in each element and reaction at supports. 14
- Area of cross section of each bar is 200mm^2 , take $E = 200 \text{ GPa}$.

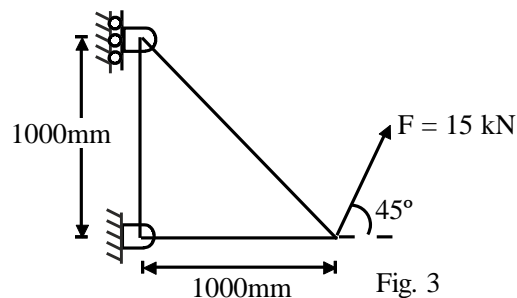


Fig. 3

OR

10. A two dimensional plate is loaded by a 10 kN force as shown in figure 4. The thickness of plate is 15 mm, $E = 2 \times 10^5 \text{ N/mm}^2$ and poisson's ratio $\nu = 0.3$. Determine the nodal displacement. 14

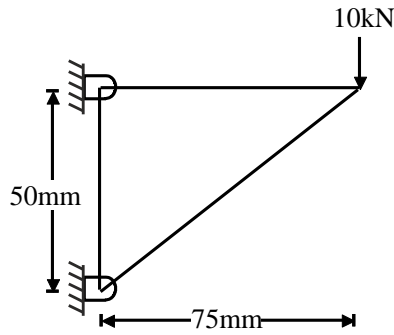


Fig. 4

11. A simply supported beam is having a rectangular cross section. The distance between the supports is 950 mm. The load of 10 kN is acting at the centre of beam. Optimize the beam for minimum deflection. Take factor of safety as 1.6. $k = d/b = 2.5$, depth d should lie between 15 mm and 150 mm. The materials are as follows 13
- SAE 3120 (oil quenched).
 - SAE 1010.
 - Aluminium 260.

OR

12. A circular shaft subjected with twisting moment of 900 Nm. The length of shaft is 700 mm and factor of safety is 1.6. Design the shaft for minimum angle of twist for the following material SAE 1010; SAE 2340; Phosphor Bronze; yellow brass ; Aluminium Bronze. 13
