ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (AUTONOMOUS) III/IV B. Tech II- Semester Regular Examinations April - 2018 DESIGN OF MACHINE ELEMENTS - II (Mechanical)

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit All Questions Carry Equal Marks All parts of the question must be answered in one place only

UNIT-I

1. a) It is required to design a pair of spur gears with 20^{0} full depth involute teeth consisting of a 20-teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to 22.5 KW, 1450 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque .the material for pinion is plain carbon steel Fe 420 (S_{ut} = 410 N/mm²), while the gear is made of grey cast iron FG 200 (S_{ut} = 200 N/mm²). The factor safety is 1.5. Design the gears based on the lewis equation and using velocity factor to account for the dynamic load. (8M)

b) The pair of worm and worm wheel is designated 2/52/10/4. 10 KW power at 720 rpm is supplied to the worm shaft. The coefficient of friction is 0.04 and pressure angle is 20° . Calculate the tangential, axial and radial components of the resultant gear tooth force acting on the worm wheel. (4M)

(**OR**)

2. a) a pair of straight bevel gears is made of grey cast iron FG 200 (E= 114000 N/mm²) .the surface endurance strength is 90 N/mm² . the number of teeth on the pinion and gear are 30 and 40 respectively. The module and face width are 6mm and 50mm respectively. The pressure angle is 20° . Determine wear strength of the tooth. (4M) b) a pair of parallel helical gears consists of 24 teeth pinion rotating at 5000 rpm and supplying 2.5 KW power to a gear. The speed reduction is 4:1. The normal pressure angle and helix angle are 20° and 23° respectively. Both gears are made of hardened steel (S_{ut} = 750 N/mm²). The service factor and the factor of safety are 1.5 and 2 respectively. The gears are finished to meet the accuracy of grade 4. In initial stages of gear design, assume that the velocity factor accounts for the dynamic load and that the face width is ten times the normal module. Assuming the pitch line velocity to be 10 m/s, estimate the normal module.

Select the first preference module and calculate the main dimensions. (8M)

<u>UNIT-II</u>

3. a) design a centre crankshaft for a single cylinder vertical engine using the following data: Cylinder bore = 125mm, (L/r) ratio = 4.5, Maximum gas pressure = 2.5MPa, length of the stroke =150 mm, weight of flywheel cum belt pulley = 1KN, Total belt pull = 2 KN, Width of the hub for flywheel cum belt pulley = 200mm.

The torque on the crankshaft is maximum when the crank turns through 25^0 from the top dead centre and at this position the gas pressure inside the cylinder is 2MPa. The belts are

in the horizontal direction. Assume suitable data and state the assumptions you make. (10M)

b) Why clutches are usually designed on the basis of uniform wear?

OR

4. a) A centrifugal clutch, transmitting 20 KW at 750 rpm consists of four shoes. The clutch is to be engaged at 500 rpm the inner radius of drum is 165 mm. the radius of the centre of gravity of the shoes is 140 mm, when the clutch is engaged. The coefficient of friction is 0.3, while the permissible pressure on friction lining is 0.1 N/mm². Calculate 1.the mass of each shoe; 2. The dimensions of friction lining. (4M)

b) The bore of a cylinder of 4 stroke diesel engine is 120mm. the maximum gas pressure inside the cylinder is limited to 4MPa. The cylinder head is made of cast iron and allowable tensile stress is 40 N/mm². Determine the thickness of cylinder head. The studs, which are made of steel , have allowable stress as 50 N/mm² . calculate 1. Number of studs, 2. Normal diameter of studs and 3. Pitch of studs. (8M)

<u>UNIT-III</u>

5. a) Fig. 1. Shows the arrangement of two brake shoes which act on the internal surface of a cylindrical brake drum. The braking force F1 and F2 are applied as shown and each shoe pivots on its fulcrum O1 and O2. The width of the brake lining is 35 mm. The intensity of pressure at any point A is 0.4 sin N/mm², where is measured as shown from either pivot. The coefficient of friction is 0.4. Determine the braking torque and the magnitude of F_1 and F_2 . (7M)



b) A workshop crane is lifting a load of 25 kN through a wire rope and a hook. The weight of the hook etc. is 15 kN. The rope drum diameter may be taken as 30 times the diameter of the rope. The load is to be lifted with an acceleration of 1 m/s². Calculate the diameter of the wire rope. Take a factor of safety of 6 and Young's modulus for the wire rope 80 kN/mm². The ultimate stress may be taken as 1800 MPa. The cross-sectional area of the wire rope may be taken as 0.38 square of the wire rope

diameter.

6. a) A crane hook has a trapezoidal section at *A*-*A* as shown in Fig.2. Find the maximum stress at points *P* and *Q*. (6M)

(5M)

 $(2\mathbf{M})$



b) A single block brake, as shown in Fig.3, has a drum diameter of 720 mm. If the brake sustains 225 N-m torque at 500 r.p.m, find :

(*a*) the required force (*P*) to apply the brake for clockwise rotation of the drum;

(*b*) the required force (*P*) to apply the brake for counter clockwise rotation of the drum; (*c*) the location of the fulcrum to make the brake self-locking for clockwise rotation of the drum; and

The coefficient of friction may be taken as 0.3.

(6M)





UNIT-IV

 a) The following data is given for a hydrostatic thrust bearing: Shaft speed=720 rpm, Shaft diameter =400 mm, Recess diameter=250 mm,

Film thickness=0.15 mm,
Viscosity of lubricant =30 cP,
Specific gravity =0.86,
Supply pressure=5MPa
Calculate the i) load carrying capacity of bearing,
ii) flow requirement iii) pumping power loss iv) frictional power loss v) temperature rise
Assume that total power loss in the bearing is converted into frictional heat. (7M)

b)A single- row deep groove ball bearing No.6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition (5M)

OR

8. a) The following data is given for 360° hydrodynamic bearing . Length to diameter ratio is 1, journal speed 1350 rpm ,diameter of journal 100 mm ,diametric clearance $100 \sim m$, external load 9000 N ,the value of minimum thickness variable is 0.3 .Find the viscosity of oil that needs to be used. (6M)

11.	ie ban bearing of	berates on the follow	ing work cycle.	
	Element No	Radial load(N)	Speed (rpm)	Element time (%)
	1	3000	720	30
	2	7000	1440	50
	3	5000	900	20

b). The ball bearing operates on the following work cycle.

The dynamic load capacity of bearing is 16.6kN. Calculate i) Average speed of rotation ii) Equivalent radial load iii) bearing life (6M)

UNIT-V

9. a)show that the belt tension ratio in v-belt drive $\frac{T_1}{T_2} = e^{\frac{z_*}{\sin r}}$ where T_1 is belt tension in tight

side, T_2 is belt tension in slack side, ~ is coefficient of friction between belt and pulley , " is angle of wrap and Γ is half groove angle of belt. (6M)

b) Design a chain drive to actuate a compressor from 15 kW electric motor running at 1000 RPM, the compressor speed being 350 RPM, the minimum centre distance is 500 mm ,the compressor operates 16 hours per day. The chain tension may be adjusted by shifting the motor on slides. (6M)

OR

a) Design a rubber belt to drive a dynamo generating 20 kW at 2250 RPM, and fitted with a pulley 200 mm diameter. Assume dynamo efficiency to be 85%. Allowable stress for belt = 2.1 MPa, Density of rubber = 1000 kg / m³, Angle of contact for dynamo pulley = 165°, Coefficient of friction between belt and pulley = 0.3 (9M)
b) Explain the polygonal effect in chain drive (3M)

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (AUTONOMOUS) III/IV B. Tech II- Semester Regular Examinations April – 2018 ENGINEERING THERMODYNAMICS-III (MECHANICAL)

Time: 3 hours

Answer ONE Question from each Unit All Questions Carry Equal Marks All parts of the question must be answered in one place only

<u>UNIT – I</u>

a) What are the differences between SI engines and CI engines. (6)
b) The following readings were taken during the test of a six cylinder four stroke oil engine.
Cylinder diameter=250mm, Stroke length=400mm, Gross m.e.p =7bar, pumping m.e.p=0.5bar, Engine speed=250 rpm, Net load on the brake=1080, Effective diameter of the brake=1.5m, Fuel used per hour=10kg, calorific value=44300KJ/Kg, Calculate i) Indicated power, ii) Brake power, iii) Mechanical efficiency, iv) Indicated thermal efficiency. (6)

(OR)

- 2 a) Explain the procedure for Morse test on IC engines. Show the method for the calculation of friction power.
 - b). What are the functions of carburettor, classifications of carburettor and explain any one of it with neat sketch (6).

UNIT – II

- a) An Otto cycle with compression ratio of 9.5. The air is at 100 kPa, 17 °C, and 600 cm³ prior to the compression stroke. Temperature at the end of isentropic expansion is 800 K. Find: a) Highest temperature and pressure in the cycle, b) amount of heat transferred, c) thermal efficiency, and d) mean effective pressure. Use constant specific heat.
 - b) Explain the following factorsi) Time loss factor, ii) Heat loss factor, iii) Exhaust blow down (6)

(**OR**)

4 a) Derive the expression for air standard efficiency of diesel cycle with the help of PV and TS Diagrams. (6)

b) A compression ignition engine working on Dual cycle takes in two fifth of its total heat supply at constant volume and remaining at constant pressure. Calculate i) Pressure and temperature at all cardinal points of the cycle. ii) The ideal thermal efficiency of the cycle. iii) The mean effective pressure of the cycle. Given:

Question Paper Code :

Max Marks: 60

(6)

compression ratio is 14, Maximum pressure in the cycle = 50 bar, air intake is at 1 bar and 15° C. Assume the standard values of specific heats. (6)

UNIT – III

5 a) What are the fuel requirements of SI engine and what are the additives generally added to prevent knock during combustion. (6)

Or

b) Describe the different stages of combustion in SI engines. Also explain abnormal combustion in SI engines

6 a) What is the difference between phenomenon of knock in CI and SI engines and list out the factors effecting knock in both CI and SI engine. (6)

Or

b) What are the different types of combustion chambers for CI engines? What is the best combustion chamber and why on basis of design (6)

$\mathbf{UNIT} - \mathbf{IV}$

7. (a) What is the effect of excessive clearance on the performance of a air compressor?

b) A reciprocating compressor of single stage and double acting type is running at 200 rpm with mechanical efficiency of 85%. Air flows into compressor at the rate of 5 m^3 /min measured at atmospheric condition of 1.02 bar, 27°C. Compressor has compressed air leaving at 8 bar with compression following polytropic process with index of 1.3. Compressor has clearance volume of 5% of stroke volume. During suction of air from atmosphere into compressor its temperature rises by 10°C. There occurs pressure loss of 0.03 bar during suction and pressure loss of 0.05 bar during discharge passage through valves. Determine the dimensions of cylinder, volumetric efficiency and power input required to drive the compressor if stroke to bore ratio is 1.5. (6)

Or

- 8. a) i)Explain the concepts of 'surging' and 'choking' (3)
 - ii) Draw inlet and outlet velocity triangles of Axial flow air compressor. (3)

b) The axial flow compressor having eight stages and with 50% reaction design compresses air in the pressure ratio 4:1. The air enters the compressor at 20° C and flows through with a constant speed of 90 m/s. The rotating blades of a compressor rotate with a mean speed of 180 m/s, isentropic efficiency of compressor may taken as 80% (6)

$\mathbf{UNIT} - \mathbf{V}$

⁹ a) In a gas turbine plant of 6MW capacity, air enters the compressor at 100 kPa, 300 K and is compressed to a pressure of 600 kPa in one stage. The temperature at the inlet of first turbine is 1000 K. The expansion takes place in two stages with reheat to 1000 K between two stages. The isentropic efficiency of the compressor is 80% and that of both turbines is 85%. A regenerator having the effectiveness of 0.72 is also incorporated in the cycle to heat the compressed air before entering into the combustion chamber. The

(6)

(4)

calorific value of fuel is 18500 kJ/kg. Determine the following:

i) A/F ratio entering the first turbine

ii) Thermal efficiency of the cycle.

iii) Air supply to plant.

iv) Fuel consumption of plant per hour.

Take for air $C_p = 1 \text{ kJ/kg} \cdot \text{K}$, x = 1.4 and for gases $C_p = 1.15 \text{ kJ/kg} \cdot \text{K}$, x = 1.34 (6M)

b) Draw the T-S diagram of turbojet engine and explain its working principle. (6M)

Or

10. a) Discuss briefly the methods employed for improvement of thermal efficiency and net work of open cycle gas turbine plant (6M)

b) Explain with a simple sketch construction and working of rocket propulsion system (6M)

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (AUTONOMOUS) III/IV B. Tech II- Semester Regular Examinations April - 2018 INDUSTRIAL ENGINEERING AND MANAGEMENT (Mechanical)

Time: 3 Hours	Max Marks: 60
Answer ONE Question from each Unit All Questions Carry Equal Marks All parts of the question must be answered in one place only	
UNIT-1	
1(a) Define management and write the functions of management?	(6M)
(b) Explain hierarchy theory of motivation?	(6M)
(OR)	
2 (a) Explain the growth of management thought?	(6M)
(b) Explain the functions of personnel management?	(6M)
UNIT II	
3 (a) Write the functions of PPC?	(6M)
(b) Explain any computerized layout planning?	(6M)
(OR)	
4 (a) Explain ABC analysis?	(6M)
(b) Explain the various types of plant layouts?	(6M)
5 (a) Explain the procedure of method study?	(6M)
(b) Write short notes on SIMO chart?	(6M)
(OR)	
6(a) Define ergonomics and explain its importance?	(6M)
(b) Explain therbligs?	(6M)

<u>UNIT-IV</u>	
7(a) Explain the principles and functions of material handling?	(6M)
(b) State the causes and consequences of industrial disputes?	(6M)
(OR)	
9(a) Evaluin the chieving of alort maintenance state different kinds of it?	
8(a) Explain the objectives of plant maintenance state different kinds of it?	(0NI)
(b) Write short notes on layoff, strikes and lockout?	(6M)
	(01)1)
<u>UNIT-V</u>	
9(a) What are the types of control charts and explain any one of them?	(6M)
(b) Construct \overline{X} and R chart for a sample size of 5	(6M)

 $(A_2 = 0.58, D_3 = 0, D_4 = 2.11)$

Sample	20	R
1	20	23
2	34	39
3	45	14
4	39	5
5	26	20
6	29	17
7	13	21
8	34	11
9	37	40
10	23	10

(OR)

10(a) Briefly explain the single and double sampling plans?

(b) An analyst taken 20 samples of size 200 from the output of final assembly. Draw the P-chart for the given data (6M)

S.No.	Defectives	S.No.	Defectives
1	9	11	26
2	7	12	18
3	14	13	11
4	15	14	8
5	08	15	10
6	07	16	10
7	09	17	15
8	11	18	13
9	16	19	09
10	12	20	12

(6M)

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (AUTONOMOUS) III/IV B. Tech II- Semester Regular Examinations April - 2018 MANUFACTURING TECHNOLOGY-III (Mechanical)

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit All Questions Carry Equal Marks All parts of the question must be answered in one place only

<u>UNIT-I</u>

1)	a)What is NC,CNC and DNC machine?Expalin cotrol features of CNC ,it's advantages	and
	limitations	(8M)
	b)What is FMS?Write a short note on FMS.	(4M)
	OR	
2)	a)What is the difference between open and closed loop system	(6M)
	b)What are different steps towards automation of a factory	(6M)

UNIT-II

3)	a) What are the functions of MCU	(4M)
	b) Write an APT Program for the given part	(8M)
		1



OR

4) a)What are different types of tape formates?Explain in brief.(6M)b)Write a manual part programme for the given example(6M)



UNIT-III

5)	a)Explain with a neat sketch the principle and construction of an autocollimator	(8M)
	b)Explain the working of an Electric comparator	(4M)
	OR	
6)	a) Write a short note on CMM and Angle gauges	(6M)
	b)Explain the principle and working of Mechanical Comparator	(6M)
	<u>UNIT-IV</u>	
7)	a)Expalin measuring gear tooth thickness using chordal thickness method	(8M)
	b)Describe gear tooth vernier with sketch	(4M)
	OR	
8)	a)With a neat sketch briefly explain Tool makers microscope	(6M)
	b)Identify the effective diameter of screw thread using three-wire method	(6M)
	<u>UNIT-V</u>	
9)	a)Describe with a neat sketch the construction, principle and operation of	(8M)
	Taylor-Habson Talysurf surface meter.	
	b)Discuss various order of geometrical irregularities in surface texture	(4M)
	OR	
10)) Explain in detail with suitable sketches about various allignment tests performed on lathe	(12M)

MODEL PAPER

Question Paper Code :

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (AUTONOMOUS) III/IV B. Tech II- Semester Regular Examinations April - 2018 OPERATIONS RESEARCH (Mechanical)

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT-I

1.Applying Simplex Algorithm, Maximize	$Z = = 3 \mathbf{x}_1 + 2 \mathbf{x}_2$
subject to:	$2 x_1 + x_2 = 18$
	$2 x_1 + 3 x_2 42$
	$3 x_1 + x_2 24$
	$x1 0, x_2 0$

OR 2. By Using the Big-M Method, Maximize $Z = x_1 + 5x_2 + 6x_3$

Subject to $x_1 + 3x_2 + 6x_3$ 2; $3x_1 + 4x_2$ 6; $x_1 + 3x_2$ 2, x_1, x_2 0 12M

UNIT-II

3. Solve the following Transportation Problem whose cost matrix is given below 12M

	De	stinat	ion			
		Α	В	С	D	Capacity
	1	1	5	3	3	34
	2	3	3	1	2	15
Origin	3	0	2	2	3	12
	4	2	7	2	4	19
	Demand	21	25	17	17	80

Hall Ticket No:

Time: 3 Hours

Max Marks: 60

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12M

4. A Company has 5jobs to be done on five machines. Any job can be done on any machine. The cost of doing the jobs on different machines are given below. Assign the jobs for different machines so as to minimize the total cost 12M

> Machines B

С

D

4.0

Ε

4.0

		UNIT -	- III		
5	15	17	18	12	20
4	6	12	10	8	13
3	12	9	4	4	4
2	9	15	24	9	12
1	13	8	10	18	19

Α

Jobs

5. A Small Maintenance Project consists of the following jobs, whose precedence relationships are given below:

Job	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Duration (Days)	15	15	3	5	8	12	1	14	3	14

Find the Critical Path, total Project Duration and Total Float for each Activity

OR

6. The following table shows the jobs of a network along with their time estimates 12M

Job	1-2	1-6	2-3	2-4	3-5	4-5	6-7	5-8	7-8
a (Days)	1	2	2	2	7	5	5	3	8
m (Days)	7	5	14	5	10	5	8	3	17
b									
(Days)	13	14	26	8	19	17	29	9	32

Draw The Project Network and find the probability of project completion in 40days

$\mathbf{UNIT} - \mathbf{IV}$

7. Find the sequence that minimizes	the total elapsed time(in hours)	required to complete the
following tasks on two machines		12M

Task	Α	В	С	D	Е	F	G	н	I
Machinel	2	5	4	9	6	8	7	5	4
Machinell	6	8	7	4	3	9	3	8	11

OR

8. A machine costs Rs.10000. Its operating cost and resale values are tabulated below: Determine at what time it should be replaced 12M

Year	1	2	3	4	5	6	7	8
Operating cost	1000	1200	1400	1700	2000	2500	3000	3500
Resale value	6000	4000	3200	2600	2500	2400	2000	1600

UNIT - V

9.In a railway yard, goods train arrives at a rate of 30trains per day, Assuming that 12M arrival time and service time distribution follows exponential distribution with an average of 30minutes, Calculate the following (I) The mean Queue Size (II) Probability that the queue size exceeds 10

(III) If the input of the train increases to an average of 33 per day, what will be the changes in the above two parameters (I) and (II)

OR

10. Find the optimum order quantity for a product, the price breaks for which are as 12M follows

Order Quantity	Unit Price
0 ≤ q1≤ 100	20/unit
100 ≤q2≤ 200	18/unit
2000 ≤q3	16/unit

The monthly demand for the product is 400 units. The storage cost is 20% of the unit cost of the product and the ordering cost is 25/-

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (AUTONOMOUS) III/IV B. Tech II- Semester Regular Examinations April - 2018 POWER PLANT ENGINEERING (ELECTIVE-I) (Mechanical)

Time: 3	Hours Max Marks	s: 60
	Answer ONE Question from each Unit	
	All Questions Carry Equal Marks	
	All parts of the question must be answered in one place only	
	<u>UN11-1</u>	
1.	Explain the layout of steam power plant with help of neat sketch. Also list out the different systems in the power plant?	12M
	(OR)	
2.	A) Discuss the chief advantages of water tube boilers over fire tube boilers?	4M
	B) Describe with a neat sketch the working of a Benson boiler and list out its advantages?	10М
		10101
	<u>UNIT-II</u>	
3.	A) Explain the working of Diesel engine power plant with the help of a neat sketch?	бM
		OIVI
	B) Discuss the various methods of supercharging	6M
	(OR)	0111
4.	A) How does inter-cooling improve the thermal efficiency of simple open gas turbine	
	plant	6M
	B) What are the advantages and limitations of gas turbine power plants?	6M
	<u>UNIT-III</u>	
5.	A) Discuss the various factors for selecting a site for hydro-electric power plant.	6M
	B) Explain the working of a pumped storage power plant with a neat diagram?	6M
	(OR)	
6.	Explain the working of Hydro - Electric power plant with the help of a neat diagram?	
		12M
	<u>UNIT-IV</u>	

7. A) Explain the working of a Boiling Water Reactor (BWR)? How does it differ from Pressurised Water Reactor (PWR)?8M B) What is a moderator? Name common moderators and discuss their advantages and limitations

4M

(OR)

8. Explain with the help of a neat diagram the construction working of a nuclear power plant.

12M

12M

UNIT-V

9. Explain the terms a) demand factor b) load factor c) diversity factor d) plant capacity factor

(OR)

10. A 60MW power station has an annual peak load of 250 MW. The power station supplies loads having maximum demands of 20MW, 17MW, 10MW and 9MW. The annual load factor is 0.45. Find (i) Average load (ii) Energy supplied per year (iii) Diversity factor?

12M
